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PROTOTYPE EVALUATION OF COMMERCIAL SECOND GENERATION LOW-NO_x BURNER PERFORMANCE AND SULFUR DIOXIDE CAPTURE POTENTIAL

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16. ABSTRACT The report gives results of tests on two large-scale staged-mixing (SM) burners developed by L and L Steinmuller of West Germany. One objective was to optimize their performance for low-NOx emissions, high efficiency, and combined NOx/SO2 control with sorbent injection. The experimental effort included three coals and three sorbents. (The expanded use of coal has fucused attention on the control of NOx and SO2 emissions from pulverized coal combustion. Staged combustion for NOx control and calcium-based sorbent injection into furnace combustion chambers for SO2 control have been evaluated.) NOx emissions from the SM and SM-II burners were sensitive to both the degree of staging and excess air levels. At optimum conditions, NOx emissions were 415, 450, and 570 ppm (corrected to 0% O2) for Utah, Saar, and Indiana coal, respectively, for the SM burner. Those for the SM-II burner were 370, 370, and 500 ppm, respectively. The highest SO2 capture with the SM burner was achieved with hydrated lime injected through the tertiary air ports, with 49% capture at a Ca/S molar ratio of 2 for Utah coal and 35% for Indiana coal. Injecting limestone through either the tertiary ports or with the coal yielded about 30-35% capture. The trends of SO2 capture for all three fuels with the SM-II burner were similar.

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Coal	Calcium Oxides	Stationary Sources	21D	
Pulverized Fuels	Calcium Carbonates	Staged Combustion		
Burners			13A	
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ABSTRACT

The expanded use of coal for utility and industrial boiler applications has focused attention of the control of NO_x and SO_2 emissions from pulverized coal combustion. Various EPA programs have demonstrated the principle of staged combustion as a means of controlling NO_x emissions. Other programs are evaluating the potential for SO_2 control with the injection of calcium-based sorbents into furnace combustion chambers. Under this program, Energy and Environmental Research Corporation (EER) and L and C Steinmüller of Gummersbach, West Germany conducted a test of Steinmuller Staged Mixing (SM) burners in the EPA Large Watertube Simulator (LWS) test facility. The objectives of the program were to provide a comparative evaluation of the SM burner in the LWS with field operation and to optimize its performance for low NO_x emissions, high efficiency, and combined NO_x/SO_2 control with sorbent injection. The experimental effort included the evaluation of two SM burner configurations in the LWS using three different coals and three sorbents. The evaluation of the two burners, the Weiher SM burner currently in operation in a 700 MW boiler in West Germany and a second generation SM burner, included characterization of burner performance and NO_x emissions and SO_2 reduction with sorbent injection through burner passages. The impact of the NO_x and SO_2 control techniques on ash characteristics, including slagging and fouling behavior, and SO_2/SO_3 speciation was also evaluated.

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ABBREVIATIONS AND SYMBOLS

Abbreviations

A_c	Weight percent ash in coal
A_p	Weight percent ash in particulate matter
Ca/S	Calcium to sulfur molar ratio, based on calcium in sorbent and sulfur in coal.
C_b	Carbon burnout, in percent. $C_b = [1 - (C_p/A_p)/(C_c/A_c)] \times 100\%$
C_c	Weight percent carbon in coal.
C_p	Weight percent carbon in particulate matter.
DMB	Distributed Mixing Burner.
EER	Energy and Environmental Research Corporation.
EPA	United States Environmental Protection Agency.
FT	Fluid temperature of ash.
HT	Hemispherical temperature of ash.
IDT	Initial deformation temperature of ash.
IFRF	International Flame Research Foundation.
IT	Inner tertiary port sorbent injection location.
LCS	L. and C. Steinmüller GMBH.
LIMB	Limestone injection with multistage burners.
LOI	Weight loss on ignition of sample upon heating, in percent.
LWS	U.S. EPA Large Watertube Simulator combustion test facility.
MAF	Analysis of coal reported on moisture and ash-free basis.
Mill	In this report, refers to sorbent injection into coal stream at pulverizer outlet.
MMF	Analysis of coal reported on moisture and mineral matter-free basis. Mineral matter consists of ash and sulfur in coal.
OT	Outer tertiary port sorbent injection location.
PA	Primary Air.
SM	Staged Mixing burner.
SM-II	Staged Mixing Burner incorporating secondary air insert to increase velocity.

SR_B	Burner Zone stoichiometry, represents percentage of air required for stoichiometric combustion passing through burner exit, including primary and secondary air.
SR_P	Primary zone stoichiometry, represents percentage of air required passing through coal nozzle (primary air).
ST	Softening temperature of ash.
TA	Theoretical air required for stoichiometric combustion.

Symbols

ΔSO_2	Difference between baseline SO_2 concentration and SO_2 concentration with sorbent injection, SO_2 capture.

1.0 SUMMARY

The reduction of NO_x, SO_x, and particulate emissions from utility and industrial boilers has been a high-priority concern of the U.S. EPA and all of the major boiler/burner manufacturers for several years. In fact, a number of unrelated concurrent efforts have been and are being conducted to develop low-NO_x burners. This program represents one portion of an effort by the EPA to compare the results of these individual studies and identify the most promising avenues for further success. Under this program, Energy and Environmental Research Corporation (EER) and L and C Steinmüller (LCS) of Gummersbach, West Germany conducted a test of Steinmüller staged mixing (SM) burners in the EPA Large Watertube Boiler Simulator (LWS) test facility. Although LCS does not build boilers in the U.S., they have already tested a burner with outboard staged air ports in a 700 MW boiler, Weiher Unit III in Germany. Sorbent injection is currently being tested in the same boiler to assess the potential for combined NO_x/SO_2 control. Tests of a scaled-down Steinmüller low-NO_x burner in the LWS will provide the EPA with a relative comparison with combined low-NO_x/SO_x operation in a large boiler.

Two LCS SM burners were evaluated in the EPA LWS for combined NO_x/SO_2 reduction potential. A scaled-down 100×10^6 Btu/hr SM burner, matching the design parameters of the 235×10^6 Btu/hr burners installed at the Weiher III boiler, was evaluated in the first phase of testing to establish a basis for comparing burner performance in the LWS with an operating boiler. The SM burner design was then optimized, resulting in the SM-II burner, by incorporating advanced LCS design concepts in a second phase of testing. These advanced designs included modifications of the secondary and tertiary air velocity, tertiary air location, and the coal nozzle configuration. These SM burners were tested with three different coals including the coal used at the Weiher boiler in Germany. SO_2 reduction potential by the injection of calcium-based sorbents through burner passages was evaluated with three different sorbents. Detailed measurements were performed at selected conditions to characterize burner performance.

The basic configuration of the Weiher SM test burner has four passages. Coal and primary air enter the burner vertically upwards and are injected through an annular passage to the burner exit. A uniform coal distribution is produced by accelerating the coal and primary air mixture from a low velocity region at the head of the burner into the annular passage. The basic SM configuration does not use an impeller at the exit of the coal annulus, so that the coal and primary air flow is purely axial. A small portion of combustion air is supplied through the large central core passage. This core air provides for cooling of ignition equipment, establishes bluff body recirculation to provide stability at the base of the flame, and also supplies an additional source of oxygen at the ignition point to improve stability. Secondary air is supplied through a single annulus around the coal pipe. Swirl is varied in the secondary air passage with a block of fixed-angle vanes that are movable to alter the distribution of air either passing through or around the vanes. Air to complete the combustion process is provided through four tertiary ports located around the burner exit.

The optimization tests of the SM burner utilized the same basic configuration. The advanced concepts evaluated during the second phase of tests included:

- Secondary passage insert to increase secondary air velocity.
- Tertiary air port location (radial distance from burner).
- Inserts in the tertiary ducts to increase velocity.
- Variable annular coal splitter to vary the coal/primary air distribution.
- Venturi insert in the annular coal nozzle.

The secondary insert, designed to increase the secondary air velocity by about 30 percent, was used throughout the second phase optimization tests in an arrangement termed the SM-II burner.

Three different fuels and three different sorbents were used during this test program. The coals tested were from Utah, Indiana, and the Saar region of Germany. These coals are all classified as high volatile bituminous coals. Both the Utah and Saar coals are low in sulfur, 0.73-0.96 percent and 0.72-0.87 percent, respectively. The Indiana coal has a medium level of sulfur of 1.35-1.46 percent. The Indiana and Utah coals have been used previously in burner development and sorbent injection studies, and thus provide a link to a broad data base. Two of the sorbents were limestones and the third was a hydrated lime. The limestones ($CaCO_3$) included Vicron 45-3 and Rheinisch-Westfaelische Kalksteinwerke (RWK) $CaCO_3$, pre-pulverized to a median particle size of 9.8 microns and 20 microns, respectively. The hydrated lime was also from RWK with a mass median diameter of 4 microns.

1.1 Burner Performance and NO_x Emissions

1.1.1 Weiher III SM Burner

The Weiher SM burner design is very simple having a single adjustable parameter, the secondary air swirler. The position of the swirler, and resulting degree of secondary air swirl generated, had little effect on emissions over most of its range; however NO_x emissions increased about 100 ppm to 550 ppm* at the maximum swirl position. For stable full load operating conditions, the flame length was about 21 feet with the ignition point at the burner exit. General operation of the test burner was observed to be typical of the SM burners at Weiher.

Emissions from the Weiher SM burner were sensitive to both the degree of staging and excess air levels. The rate of decrease in NO_x emissions ranged from 5 to 7.5 ppm per percent theoretical air change in the burner zone stoichiometry. The effect of excess air change was slightly greater, 9 to 15 ppm decrease in NO_x for each percent theoretical air decrease. At nominal design point conditions (SR_B = 80% TA, SR_T = 125% TA), NO_x emissions were 415, 450, and 570 ppm for Utah, Saar, and Indiana coal, respectively.

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* Note: All emissions are reported on a dry basis and are corrected to 0 percent O_2.

1.1.2 SM-II Burner

The SM-II burner was optimized using both the adjustable burner parameters and hardware modifications to the burner geometry. The effect of each parameter evaluated is summarized below.

Secondary Air Swirl. The position of the swirl vane device, and the resulting degree of secondary air swirl generated, had negligible effect on emissions as long as flame stability was maintained. However, decreasing swirl resulted in progressively increasing flame length and flame detachment.

Core Air Flow. Increasing core air flow generally decreased NO_x emissions with no significant effect on combustion efficiency as measured by CO levels. At the highest flow through the core air passage, flame length and detachment increased.

Secondary Air Velocity. Increasing the secondary air velocity with an insert installed in the throat of the Weiher SM burner had no significant effect on emissions. Flame stability was improved to allow stable operation at lower burner zone stoichiometry.

Tertiary Port Location. Of the two locations tested, the set of tertiary air ports further from the burner centerline produced lower NO_x emissions, with the difference becoming greater at lower burner zone stoichiometry.

Tertiary Air Velocity. Tertiary velocity was varied using inserts in the ports that increased the velocity by about fifty percent. For both the inner and outer port locations, the higher tertiary air velocity, i.e. smaller port diameter, produced lower NO_x emissions. Again the difference in emissions became greater as staging was increased.

Coal Nozzle Design. Two inserts for the annular coal nozzle were evaluated. A variable blockage device which divided the coal stream and increased the primary velocity produced a narrow flame which reduced NO_x under unstaged conditions. Staging this configuration significantly increased CO emissions. This device also resulted in a much higher pressure drop across the coal nozzle which caused operational problems for the pulverizer and primary air system. A venturi-shaped insert increased NO_x emissions along with flame stand off. Best overall performance was achieved with the baseline annular coal nozzle.

The optimized configuration of the SM-II burner incorporated the following hardware:

- Secondary air insert
- Baseline annular coal nozzle
- Outer tertiary port location
- Small diameter, high velocity tertiary air ports.

This configuration produced stable full load flames about 21 feet long. NO_x emissions at full load design point conditions (SR_B = 80% TA, SR_T = 125% TA) for this optimized SM-II burner were 370, 370, and 500 ppm for Utah, Saar, and Indiana coals, respectively. Emissions from the SM-II burner were also sensitive to burner zone stoichiometry and overall excess air. The nominal rate of change in NO_x with burner zone stoichiometry was about 10 ppm per percent theoretical air change. The effect of excess air was less, about 6.5 ppm decrease in NO_x for each percent change in excess air.

1.1.3 Comparison of Weiher SM and SM-II Burners

Overall performance of the basic Weiher SM burner was improved with the optimum hardware. NO_x emissions were lower at design point conditions and combustion efficiency was higher. The range of operation, including excess air and turndown, was maintained if not improved. Range of operation could probably be further improved by design changes in secondary swirl generation. Increasing swirl would allow staged operation over the entire load range with stable, attached flames.

The NO_x emissions from the optimum SM-II design were more sensitive to burner zone stoichiometry than the Weiher burner, while the effect of excess air on emissions was much less for the optimized burner. Combustion efficiency with the Saar coal was improved with the optimized burner.

1.2 Sulfur Dioxide Control

1.2.1 Weiher SM Burner

The SO_2 reduction tests with sorbent injection for the Weiher SM burner utilized three sorbents, three injection locations, and three coals. The sorbents, two limestones and a hydrated lime, were injected with the coal at the pulverizer outlet, through nozzles located on the axis of the inner tertiary air ports, and, through nozzles located on the axis of the outer tertiary ports. For the Weiher SM burner configuration, tertiary air flowed through the inner set of ports only. Most of the SO_2 tests were conducted with the Saar coal to obtain data for comparison with sorbent injection tests planned at the Weiher III boiler.

The two limestone sorbents, the Vicron and the RWK $CaCO_3$, achieved similar SO_2 reduction when injected with the Saar coal, 35 percent and 32 percent at a Ca/S molar ratio of 2, respectively. Sulfur capture with RWK hydrated lime injected with the coal was lower, particularly for Ca/S molar ratios greater than 2. Greater SO_2 reduction was achieved with the injection of the hydrated lime through either the inner or outer tertiary ports, with 49 percent and 54 percent capture at a Ca/S molar ratio of 2, respectively. Capture with the Vicron and RWK limestones was again similar for injection through the inner tertiary air ports, about 32 percent at a Ca/S molar ratio of 2. However, injection through the outer tertiary ports resulted in substantially higher capture with the Vicron limestone (40 percent at a Ca/S molar ratio of 2) than with the RWK limestone (29 percent).

The trends for SO_2 reduction were similar for the two U.S. coals with the Weiher burner. Highest capture was achieved with the RWK $Ca(OH)_2$ injected through the inner tertiary ports, with 49 percent capture at a Ca/S molar ratio of 2 for Utah coal and 35 percent for Indiana coal. Injection of Vicron through the tertiary ports yielded higher SO_2 capture than injection with the coal, about 35 percent to 30 percent, respectively, for both U.S. coals.

1.2.2 SM-II Burner

The potential for SO_2 reduction for the SM-II burner were conducted with two sorbents; Vicron limestone and RWK $Ca(OH)_2$, through three injection locations; with the coal, through the inner tertiary ports, and through the outer tertiary ports. Sorbent was injected only through the tertiary ports through which the air flowed.

The trends for all three fuels with the optimized SM burner were similar, with the best performance in terms of sulfur dioxide capture achieved by injecting RWK $Ca(OH)_2$ through the outer tertiary ports and with little difference in the effectiveness of injection location for the Vicron limestone. Levels of SO_2 capture at a Ca/S molar ratio of 2 for the higher sulfur content Indiana coal were 50 percent with the RWK $Ca(OH)_2$ through the outer tertiary ports, 33 percent with Vicron through the outer tertiary ports, and 30 percent when Vicron was injected with the coal. For each combination of sorbent and injection configuration, sulfur capture is an average of approximately 4 percent higher with the higher sulfur content Indiana coal than with the Utah coal. Intuitively, an effect of composition (sulfur content, in particular) would be expected. The sulfation reaction would be thought to be driven in part by the concentration of sulfur species.

1.2.3 Comparison of Weiher SM and SM-II Burners

In general, the trends in SO_2 capture for various sorbent and injection locations for the Weiher and optimized SM burner were similar. The most effective sorbent with Saar and Utah coals was the RWK hydrated lime injected through the outer tertiary ports for both burners. For the Weiher SM burner, limestone injection through the tertiary ports achieved SO_2 reduction comparable to the hydrated lime. The injection location of the limestone sorbent had some effect on capture achieved with the Weiher burner, but essentially no effect with the optimized burner. Tertiary air velocity, varied using inserts during tests with the optimized burner, did not measurably affect capture. Coal type, or composition, had little effect on SO_2 capture by sorbent injection for the optimum and Weiher burners. Operating variables that had negligible effect on SO_2 reduction with sorbent injection for both burners included degree of staging and firing rate.

During the Weiher SM burner tests, NO_x emissions increased when limestone was injected into the mill with the Saar coal. The increase in NO_x appeared to be proportional to the sorbent injection rate, ranging from 5 to 15 percent over the baseline NO_x emissions as sorbent flow increased. This phenomena occurred with the U.S. coals also but to a much lesser degree. No measurable change in NO_x emissions occurred during the sorbent injection tests with the optimized SM burner.

2.0 INTRODUCTION

The reduction of NO_x, SO_x, and particulate emissions from utility and industrial boilers has been a major objective for the U.S. EPA and all of the major boiler burner manufacturers for several years. In fact, a number of unrelated concurrent efforts have been and are being conducted to develop low-NO_x burners. Various EPA programs have demonstrated the principle of staged combustion as a means of controlling NO_x emissions from coal-fired combustion systems, and have defined design guidelines for the Distributed Mixing Burner (DMB) concept as a viable control technology for new and retrofit boiler applications. This experimental program represents one part of an ongoing series of EPA-sponsored investigations designed to evaluate the performance of second generation low-NO_x burners and to compare the results of these individual studies.

L and C Steinmüller (LCS) of Gummersbach, West Germany, is engaged in a corporate research program to develop efficient firing systems which will reduce pollutant emissions from coal-fired power plants. Corporate funds have been used to develop and demonstrate a low-NO_x staged coal burner and assess the use of the same burner design in conjunction with sorbents to provide simultaneous control of nitrogen and sulfur oxides. The staged mixing (SM) burner is the standard LCS burner and has been retrofitted to a 700 MW power plant, Weiher III, demonstrating reduced NO_x emissions and satisfactory operation for over 5 years. Tests are planned at the same power plant to determine the operational impact of sorbent injection for SO_x control. This program provided the opportunity to share in the development/demonstration efforts and to obtain comparative information on a combined NO_x/SO_x control system when installed in an operating boiler and when tested in the EPA Large Watertube Simulator (LWS) experimental facility at Energy and Environmental Research Corporation (EER).

The objectives of this program were to:

1. Provide a comparative evaluation of the SM burner in the LWS with field operation.

2. Optimize the operation of the SM burner for low NO_x emissions, high combustion efficiency, and combined NO_x/SO_x control with sorbent injection.

3. Obtain information on slagging and fouling tendencies as well as characterize the spent sorbent fly ash mixture during combined NO_x/SO_x control.

4. Contribute to the data base for burner and furnace scaling effects on burner performance and pollutant emissions.

These objectives were accomplished in two phases of testing in the LWS. Phase I consisted of the evaluation of a scaled-down version of the burner installed in the Weiher boiler. Testing of the Weiher SM burner provided data that enabled direct comparison with previous pilot-scale tests conducted in the EPA LWS and at the International Flame Research Foundation (IFRF) as well as results from the Weiher boiler. This first phase of tests involved characterizing the performance of the Weiher SM burner in the LWS in terms of combustion efficiency and flame characteristics, as well as NO_x and SO_x control potential. The Phase II tests involved incorporating LCS advanced design concepts to optimize the performance of the SM burner for NO_x control and combustion efficiency. This optimized burner, designated SM-II, was also evaluated for SO_x control potential by injection of calcium-based sorbents.

3.0 EXPERIMENTAL SYSTEMS

3.1 Steinmüller Staged Mixing Test Burners

L. and C. Steinmüller GMBH developed the Staged Mixing (SM) burner for NO_x control in 1976. The Weiher boiler in Germany was fully retrofitted with SM burners in late 1978 and has achieved sixty months of satisfactory low NO_x operation thus far. Several configurations of the basic SM burner were evaluated during this program. For this EPA program, the burner used in the initial phase of testing was a scaled-down version of the SM burners installed in the Weiher boiler. Testing of the Weiher SM burner in the LWS establishes a basis for extrapolating burner performance in the LWS to operating boilers. The burner configurations tested in the second phase incorporated hardware modifications that reflect some of Steinmüller's advanced design concepts.

The basic configuration of the Weiher SM burner used for the Phase I tests is shown in Figure 3-1. Coal and primary air enter the burner vertically upwards and are injected through an annular passage to the burner exit. A uniform coal distribution is produced by accelerating the coal and primary air mixture from a low velocity region at the head of the burner into the annular passage. The basic SM configuration does not use an impeller at the exit of the coal annulus, so that the coal and primary air flow is purely axial. A small portion of combustion air is supplied through the central core air passage. The core air provides for cooling of ignition equipment, establishes bluff body recirculation at the base of the flame, and also supplies an additional source of oxygen at the ignition point to improve stability. Secondary air is supplied through a single annulus around the coal pipe. Swirl is varied in the secondary air with a block of fixed-angle vanes that are moved to change the distribution of air either passing through or around the vanes. Steinmüller defines secondary air swirl settings according to the axial position of the vanes as shown in Table 3-1, where a setting of 0 is defined for the minimum swirl position and 5 for the maximum swirl position. Air to complete the combustion process is provided through tertiary ports located around the burner exit.

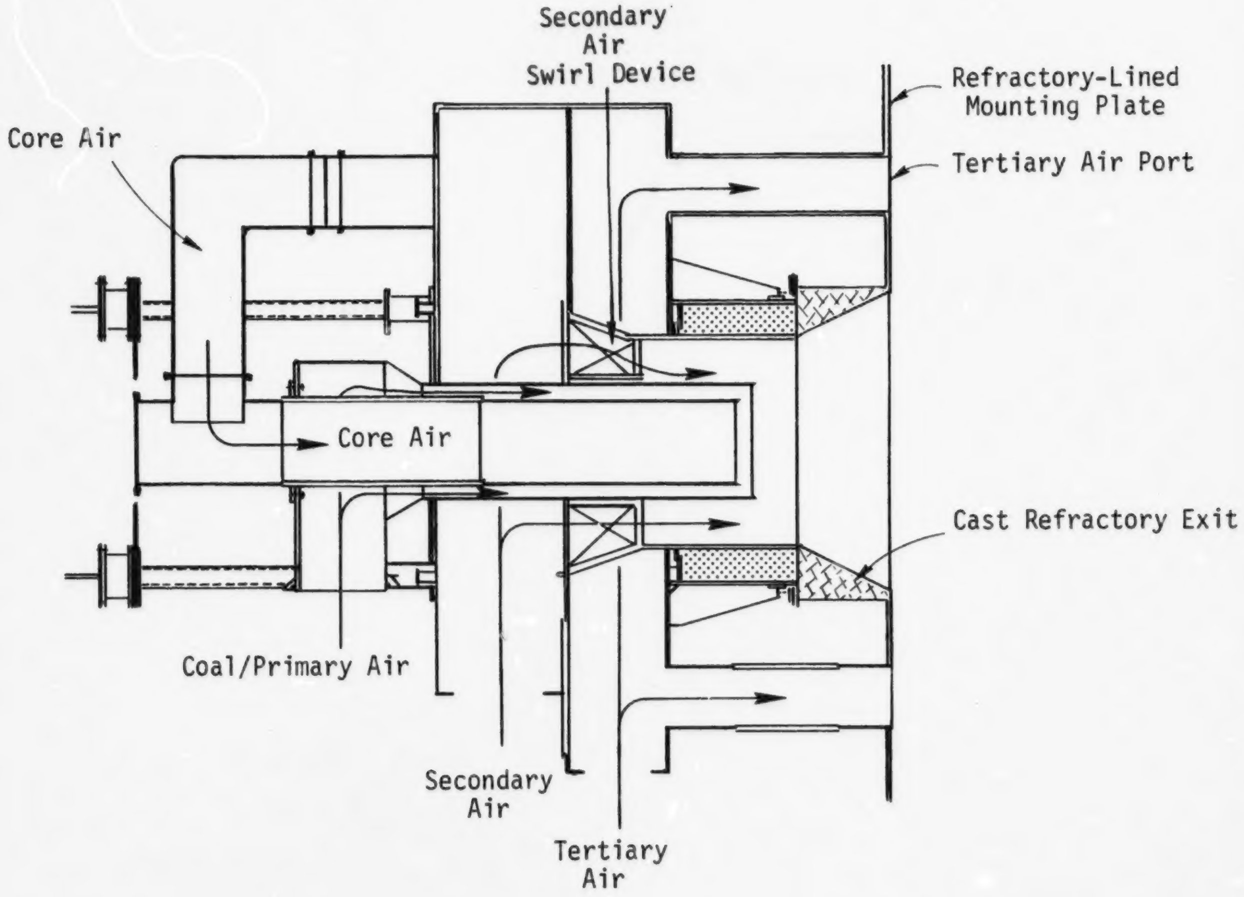

Secondary
Air
Swirl Device
Refractory-Lined
Mounting Plate
Core Air
Tertiary Air Port
Core Air
Cast Refractory Exit
Coal/Primary Air
Secondary
Air
Tertiary
Air

Figure 3-1. Weiher SM burner configuration.

TABLE 3-1 SECONDARY AIR SWIRLER SETTINGS

Axial	Position	Swirl Setting	Degree of Swirl
(inches)	(mm)		
0	0	5	Maximum
1.9	48	4	↓
3.8	96	3	
5.67	144	2	
7.56	192	1	
9.45	240	0	Minimum

In a field installation, such as at the Weiher boiler, the total combustion air is supplied from a common windbox and is distributed into core, secondary, and tertiary air passages with internal flow dividers. To facilitate parametric testing in the LWS, the following modifications were incorporated into the burner design:

- Core air independently supplied and metered.
- Separate windboxes for secondary and tertiary air, individually supplied with metered preheated air.
- Two sets of four tertiary air ports at two radial locations.

The tertiary ports were located along the 45^{0} axis from the horizontal plane through the burner centerline. The ports were arranged at two different locations as shown in Figure 3-2. The ports closest to the center, or the inner tertiaries (IT), were located at a radial distance of 1.25 throat diameters from the center, while the set of ports further from the center, or the outer tertiaries (OT), were located 1.75 throat diameters from the center. In addition, control dampers were installed at each port to provide air flow between to either the inner or outer tertiary ports. These dampers were also calibrated to establish uniform flow distribution to each tertiary air port in service. A sorbent injection nozzle was installed on the axis of each tertiary port for use during the SO_2 reduction experiments.

The basic configuration of the SM burner used in the Phase II tests, designated SM-II, was similar to that used in the first phase, as shown in Figure 3-3. The modifications that were evaluated during the second phase of tests included:

- Secondary passage insert to increase secondary air velocity
- Tertiary air location
- Inserts in the tertiary ducts to increase the tertiary air velocity
- Variable annular coal splitter to vary the coal/primary air distribution
- Venturi insert in the annular coal nozzle

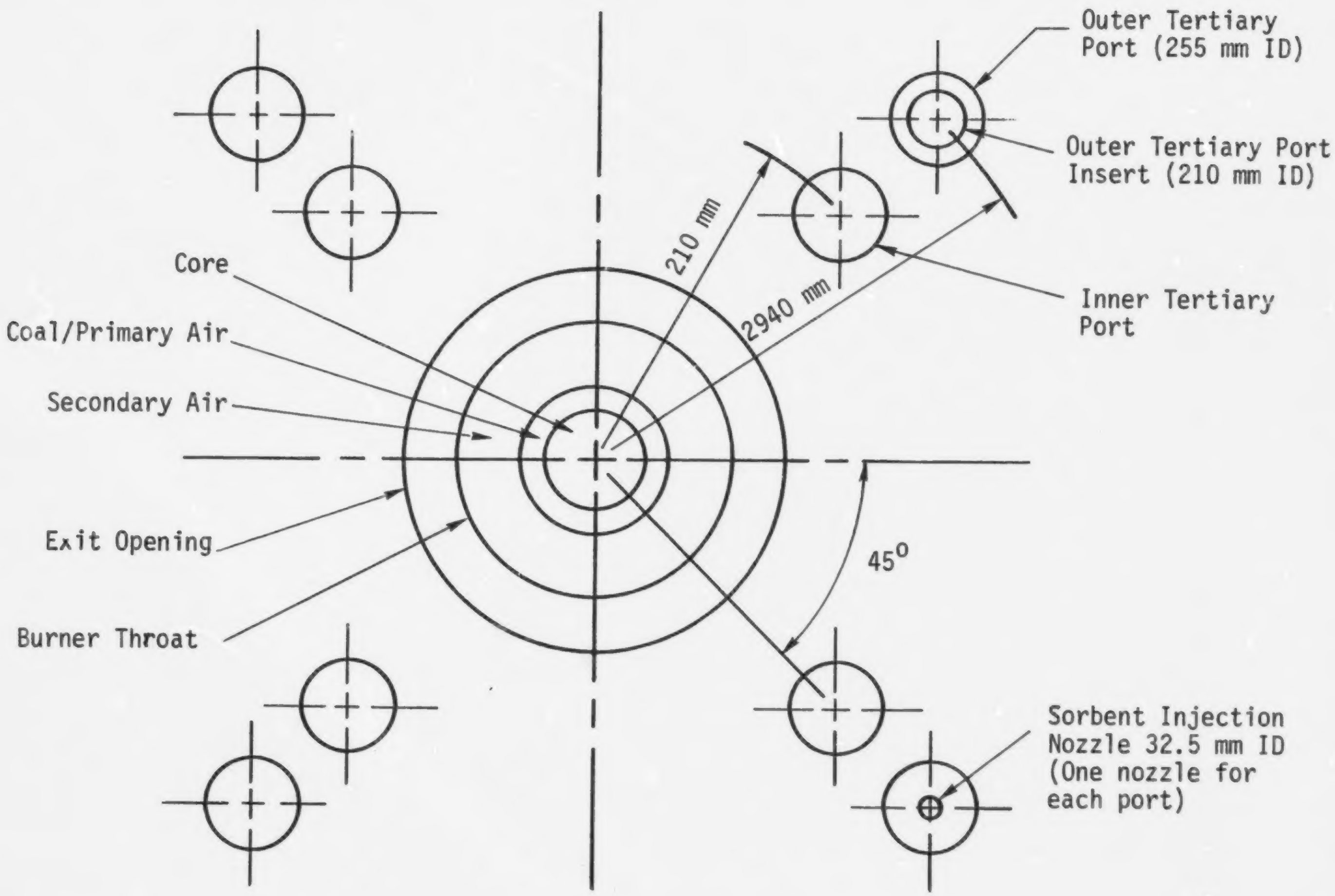

Outer Tertiary Port (255 mm ID)
Outer Tertiary Port Insert (210 mm ID)
210 mm
2940 mm
Inner Tertiary Port
Core
Coal/Primary Air
Secondary Air
Exit Opening
Burner Throat
45°
Sorbent Injection Nozzle 32.5 mm ID (One nozzle for each port)

Figure 3-2. Installation arrangement.

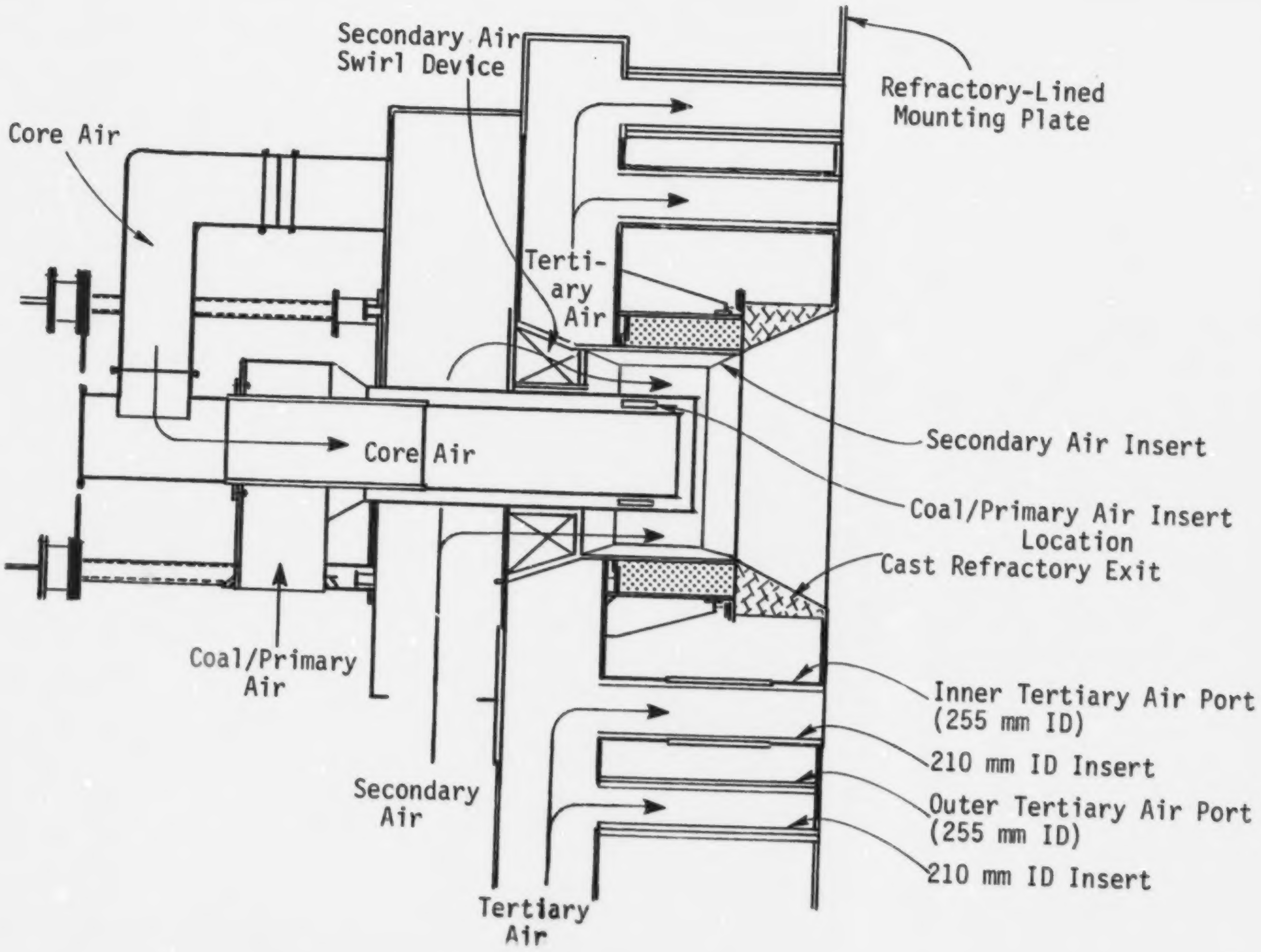

Secondary Air
Swirl Device
Core Air
Refractory-Lined
Mounting Plate
Terti-
ary
Air
Core Air
Secondary Air Insert
Coal/Primary Air Insert
Location
Cast Refractory Exit
Coal/Primary
Air
Inner Tertiary Air Port
(255 mm ID)
210 mm ID Insert
Outer Tertiary Air Port
(255 mm ID)
210 mm ID Insert
Secondary
Air
Tertiary
Air

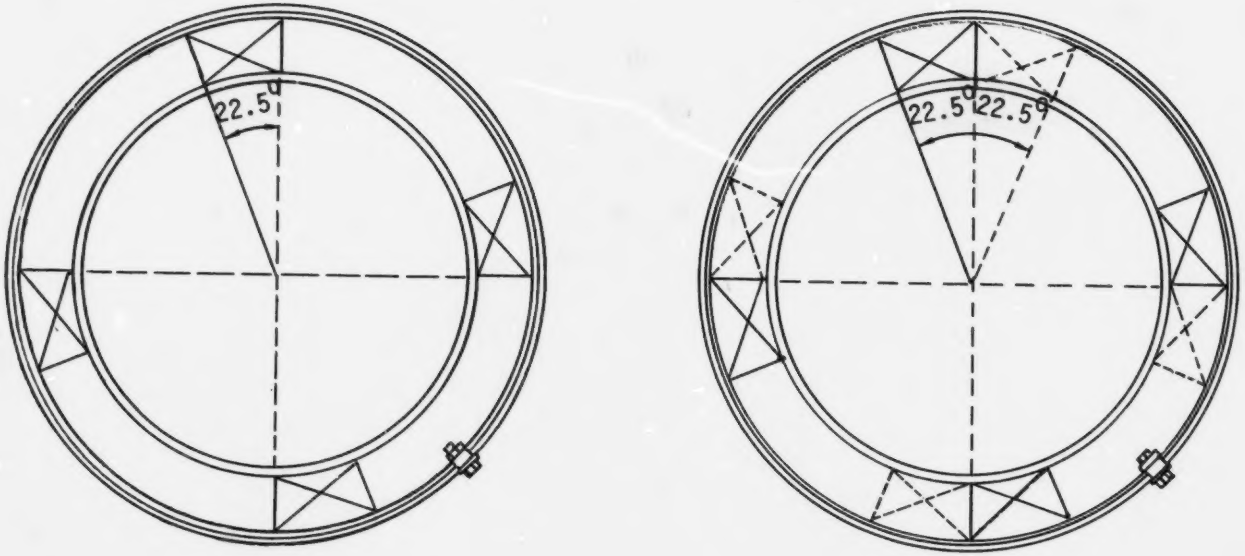
Figure 3-3. SM-II burner configuration used in Phase II testing.

The secondary insert was designed to increase the secondary air velocity by about 30 percent. This change is representative of Steinmüller's new design for commercial SM burners and, therefore, was used throughout the second phase of tests. The location of the tertiary air ports used in the first phase was the inner set, shown in Figure 3-2. During the second phase, SM burner performance was evaluated with both the inner and outer set of tertiary air ports. Tertiary air velocity was also varied during Phase II using inserts that increased the velocity by about 50 percent.

Two coal/primary air annulus devices were evaluated for NO_x reduction potential. Both devices were installed in the location shown in Figure 3-3. One device divided the coal annulus into four streams, as shown in Figure 3-4. The blades of this spreader could be adjusted by rotating the core pipe to vary the area blocked by the blades from 25 to 50 percent. The blades were at right angles to the direction of flow and did not induce swirl to the coal stream. The other device was a venturi-shaped insert installed near the end of the coal pipe, shown in Figure 3-5. The venturi was a simple design with no external adjustments. It was expected to change the coal/primary air distribution at the nozzle exit by accelerating the stream through the throat of the venturi. The inertia of the larger coal particles would, perhaps, tend to stay concentrated toward the inside of the annulus, while the finer fraction would follow the streamlines in the diverging section of the venturi.

3.2 Fuels and Sorbents

Three different fuels and three sorbents were utilized in both test series of Steinmüller SM burners in the LWS. Table 3-2 summarizes the composition of these coals. The Utah coal, from the Starpoint 1 and 2 mines in Wattis, Utah, has been used at EER as the base fuel in the development of low-emission, high efficiency burners. Utah coal has been used as the base fuel for most of the burner development tests at EER and allows comparison of the performance of the two SM burners with a number of other burners. Its characteristics includes low sulfur content (0.73-0.96 percent, dry) and high volatile matter (39.87-42.55 percent, dry). Indiana coal, from the Three



a) 25% Blockage

b) 50% Blockage

Figure 3-4. Coal splitter insert.

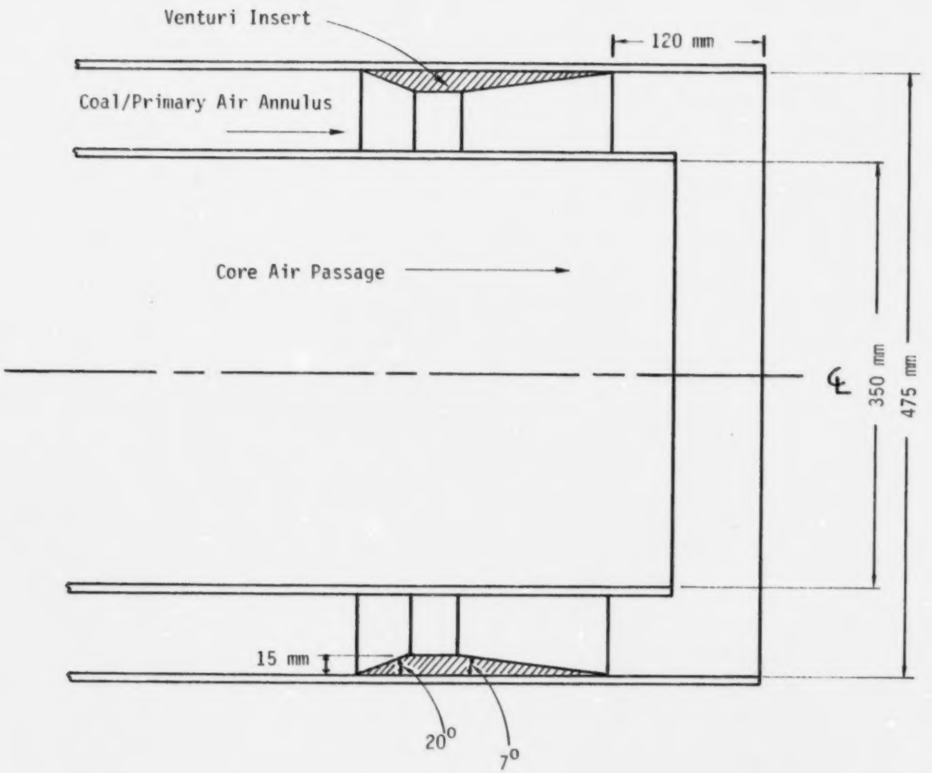

Venturi Insert
120 mm
Coal/Primary Air Annulus
Core Air Passage
℄
350 mm
475 mm
15 mm
20°
7°

Figure 3-5. Primary air annulus Venturi insert arrangement.

TABLE 3-2 SUMMARY OF COAL COMPOSITION

Coal	Utah				SAAR				Indiana			
	Phase I		Phase II		Phase I		Phase II		Phase I		Phase II	
	As Rec'd	Dry	As Rec'd	Dry	As Rec'd	Dry	As Rec'd	Dry	As Rec'd	Dry	As Rec'd	Dry
Proximate (%Wt)												
Moisture	4.44	0.00	10.78	0.00	2.80	0.00	5.11	0.00	5.98	0.00	9.17	0.00
Ash	9.05	9.47	9.42	10.56	8.02	8.75	7.26	7.65	9.48	10.08	11.88	13.08
Volatiles	38.10	39.87	37.96	42.55	31.37	32.27	31.59	33.29	29.83	31.73	28.40	31.26
Fixed C	48.41	50.66	41.84	46.89	57.81	59.48	56.04	59.06	54.71	58.19	50.55	55.66
Sulfur (% Wt)	0.92	0.96	0.66	0.73	0.85	0.87	0.68	0.72	1.27	1.35	1.33	1.46
Btu/lb	12045	12605	11380	12755	13107	13485	12803	13491	11847	12600	10688	11766
MMF Btu/lb		14070		14422		14834		14732		14182		13745
MAF Btu/lb		13923		14261		14697		14610		14013		13536
Ultimate (% Wt)												
Moisture	4.44	0.00	10.78	0.00	2.80	0.00	5.11	0.00	5.98	0.00	9.17	0.00
Carbon	68.45	71.63	63.51	71.18	74.32	76.46	72.81	76.73	68.45	72.80	62.32	68.61
Hydrogen	4.82	5.05	4.72	5.29	4.69	4.82	4.67	4.93	4.30	4.57	3.75	4.13
Nitrogen	1.16	1.21	1.20	1.35	1.03	1.06	1.09	1.15	1.19	1.27	1.17	1.28
Sulfur	0.92	0.96	0.66	0.73	0.85	0.87	0.68	0.72	1.27	1.35	1.33	1.46
Ash	9.05	9.47	9.42	10.56	8.02	8.25	7.26	7.65	9.48	10.08	11.88	13.08
Oxygen*	11.16	11.68	9.71	10.89	8.29	8.54	8.38	8.82	9.33	9.93	10.38	11.44
Elemental Ash (% Wt.)												
SiO_2		63.70				43.59				57.60		
Al_2O_3		19.95				24.86				25.21		
TiO_2		0.78				0.88				0.93		
Fe_2O_3		5.77				10.97				9.82		
CaO		4.69				4.85				1.28		
MgO		1.20				3.19				0.75		
Na_2O		0.77				0.47				0.38		
K_2O		1.39				3.27				2.45		
P_2O_5		0.40				0.18				0.27		
SO_3		5.05				5.38				0.84		
Forms of Sulfur (% Wt)												
Sulfate	0.18	0.19			0.02	0.02			0.35	0.37		
Pyritic	0.17	0.18			0.37	0.38			0.21	0.22		
Organic	0.57	0.59			0.46	0.47			0.71	0.76		

* Note: Oxygen by difference

States Trucking Mine in Huntingburg, Indiana, has been used as the base fuel in the development of LIMB because of its medium range of sulfur content (1.35 - 1.46 percent, dry). The Indiana coal is significantly lower in volatiles (31 percent, dry) compared to the Utah coal and would test the adaptability of the SM burners to various coals. The Saar coal from Germany is the coal burned in the Weiher boiler and permits the extrapolation of SM burner peformance in the LWS to an operating boiler. The Saar coal has a low sulfur content (0.72-0.87 percent, dry) comparable to the Utah coal and also is relatively low in volatiles (33 percent, dry) similar to the Indiana coal. The Raymond bowl mill used for these tests pulverized each of the three coals to acceptable fineness (70 percent through 200 mesh). The range of fineness achieved during tests is listed in Table 3-3. Typical size distributions obtained with a full size analysis are shown in Figure 3-6. The size distributions are very similar for the three coals, although small variations occurred during the test program.

There was relatively little change in the composition of each coal used for the two phases of testing. Differences in the Utah coal between test series probably result from shipments of coal about a year apart. Only slight differences, caused by physical weathering over a period of about 8 months are noted for the Saar and Indiana coals. The differences in the Indiana coal are probably related to observed changes in the physical characteristics of the coal. During the initial phase of testing, the raw coal was relatively small in size and fairly homogeneous. For the second test phase, the remaining Indiana coal consisted of a mixture containing both large pieces and some fines. The heterogeneous consistency may account for differences in composition.

As part of an extensive coal composition study, both petrographic and thermogravimetric analyses were conducted for the three coals during the first phase of testing. The mineral-free basis maceral analyses are listed in Table 3-4. The inertinite content of the Utah and Saar coals is much less than for the Indiana coal. However, reflectogram results indicate that Saar coal is of a higher rank than either Utah and Indiana coals. The mean maximum reflectance of Saar coal is 0.93 percent compared to 0.66 and 0.60

TABLE 3-3 SUMMARY OF COAL FINENESS

Coal Type	Range of Size Distribution (% through 200 Mesh)	Mean (%)	Standard deviation (%)
Utah	69.0 - 79.5	74.8	± 3.3
Saar	70.1 - 72.2	71.2	± 1.5
Indiana	70.2 - 75.6	72.9	± 3.8

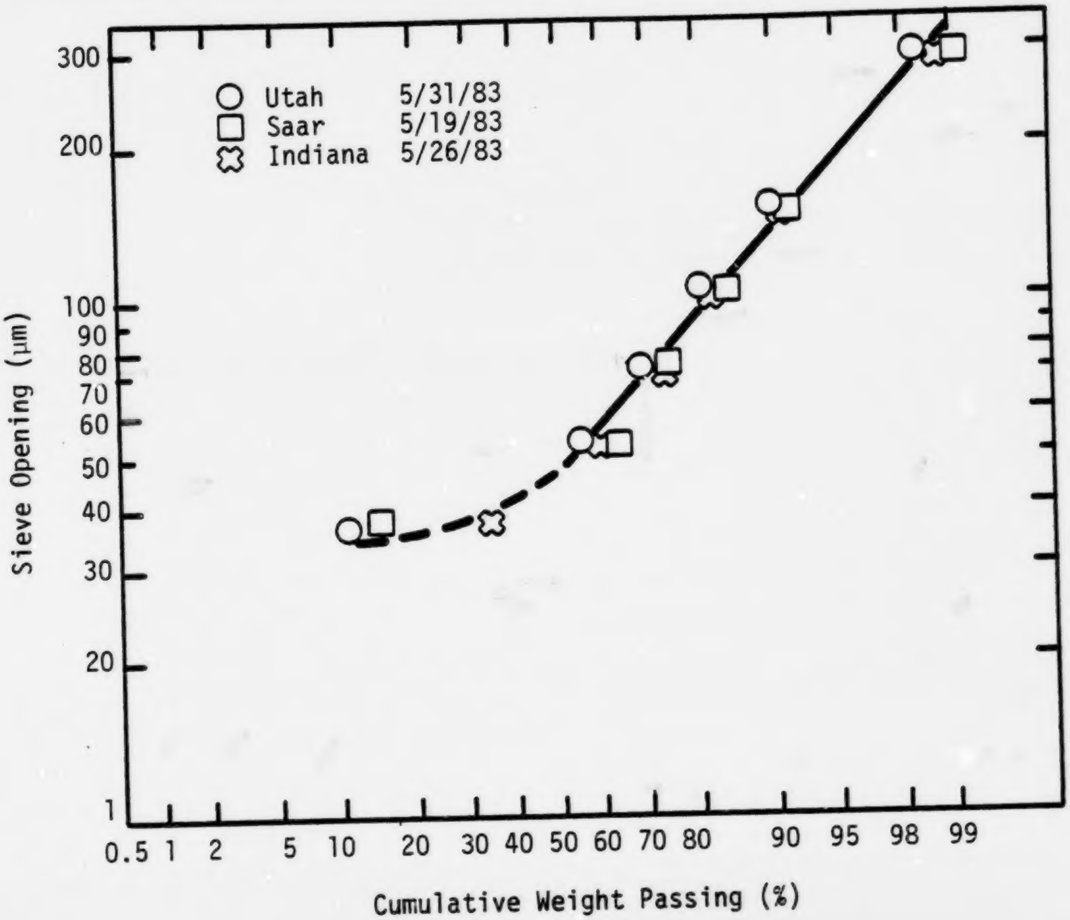


Figure 3-6. Typical coal size distribution.

TABLE 3-4. PETROGRAPHIC ANALYSES FOR UTAH, SAAR, AND INDIANA COALS

MACERAL ANALYSIS (mineral-free basis)	UTAH		SAAR		INDIANA	
	(%)	(%)	(%)	(%)	(%)	(%)
VITRINITE		87.2		78.7		71.1
"Normal Vitrinite"	87.0		36.2		71.1	
"Pseudovitrinite"	0.2		42.5		0.0	
INERTINITE		10.4		12.6		23.0
Fusinite	0.5		1.3		5.8	
Semifusinite	6.3		6.9		11.3	
Macrinite	0.3		0.9		0.4	
Micrinite	0.7		1.3		3.7	
Sclerotinite	0.3		0.5		0.2	
Inertodetrinite	2.3		1.7		1.6	
LIPTINITE		2.4		8.7		5.9
Sporinite	1.2		7.8		4.5	
Resinite	1.1		0.4		0.5	
Cutinite	0.1		0.5		0.9	
Alginite	0.0		0.0		0.0	
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
MEAN MAXIMUM REFLECTANCE	0.60 0.60%		0.93 0.93%		0.66%	
FREE-SWELLING INDEX	1/2		2		1/2	

percent for Indiana and Utah coals, respectively. This places the Saar coal at the high rank end of the high volatile A bituminous class of coals. For coals of this rank, completeness of combustion may be affected by the degree of plastic behavior. The degree of plasticity for the Saar is considerably higher, with a free swelling index of 2 compared to 0.5 for the other two coals. Saar coal also has a high proportion of pseudovitrinite compared to the Utah and Indiana coals. Some researchers believe that pseudovitrinite is less reactive in the carbonization process than normal vitrinite, which may result in poor burnout for high pseudovitrinite coals.

Thermogravimetric analysis for the three test fuels is summarized in Figure 3-7. The tests were performed in air by heating pulverized coal samples from room temperature to 1100°C at a rate of 20°C/min. The weight loss profile for the Saar coal differs significantly from those of the other two coals. The derivative weight loss curve (dTGA) indicates about 100°C difference at the threshold of volatile escape from the sample. This corresponds to about a 5 minute delay at 20°C/min. However, the behavior of the coals in a flame where heating rates reach 10^4 - 10^5 °C/sec cannot necessarily be deduced from this slow combustion analysis.

Three sorbents were used during these studies to evaluate SO_2 reduction potential. Two of the materials were processed limestones, Vicron 45-3 and Rheinisch-Westfaelische Kalksteinwerke (RWK) $CaCO_3$. The third material was a processed hydrated lime, RWK $Ca(OH)_2$. The characteristics of these materials are listed in Table 3-5 and the corresponding size distributions are shown in Figure 3-8. Vicron is a commercially available pulverized limestone used as the base sorbent for development of LIMB technology at EER. The two German sorbents, RWK $CaCO_3$ and RWK $Ca(OH)_2$, were used to evaluate potential sorbents for use at the Weiher boiler. Vicron 45-3 is about 99 percent pure $CaCO_3$ with a mass median diameter of 9.8 μm. The German sorbents are similarly high purity materials, with the RWK $CaCO_3$ 97 percent $CaCO_3$ and RWK $Ca(OH)_2$ 96-98 percent $Ca(OH)_2$. The mass median diameters of the German sorbents are 20 μm for the limestone and about 4 μm for the hydrated lime.

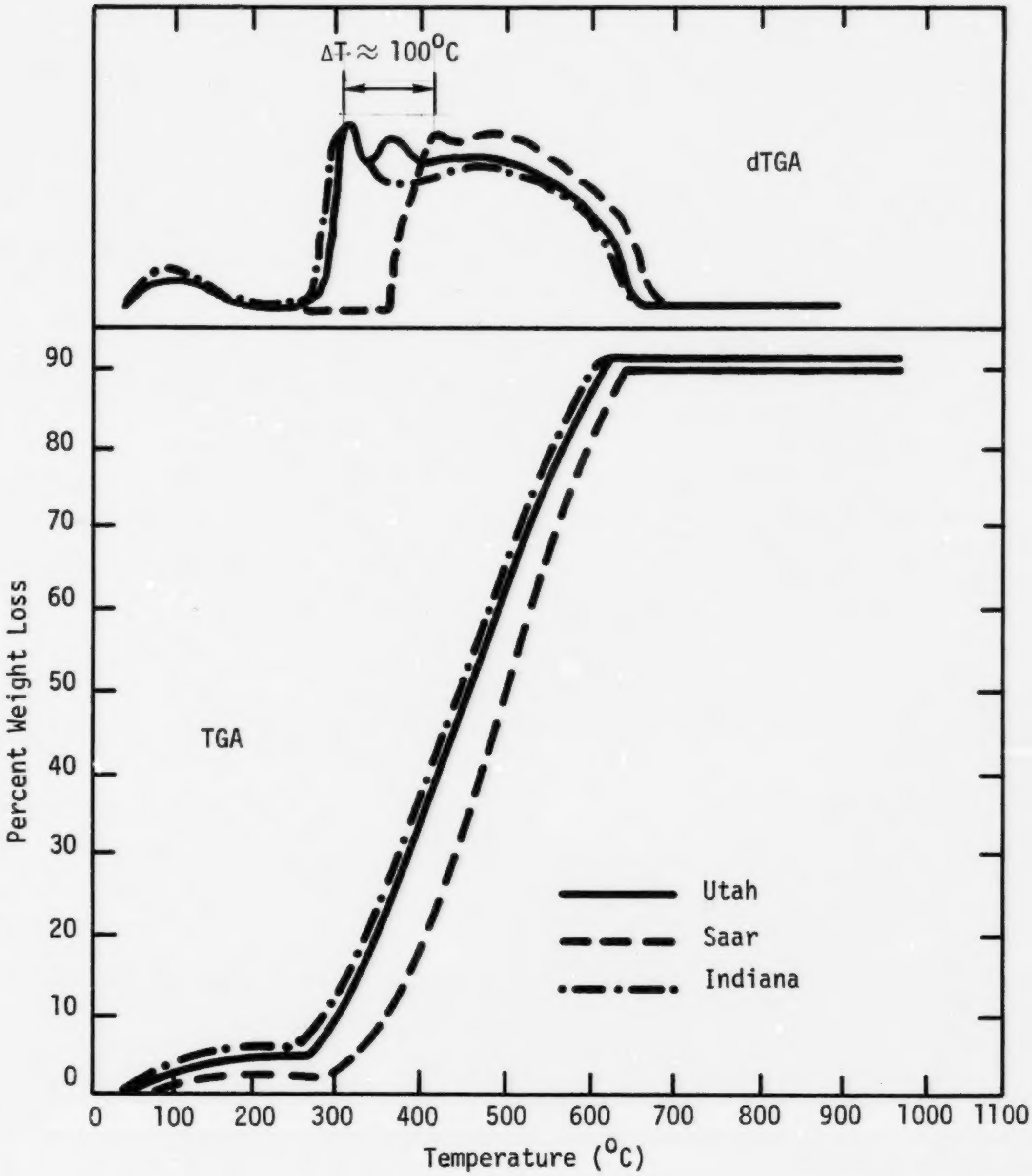


Figure 3-7. Thermogravimetric analysis of test coals.

TABLE 3-5 SORBENT CHARACTERISTICS

Sorbent	Chemical Formula	Physical Properties			Elemental Analysis (% by weight)										
		Median Diameter (μm)	Density (gm/cm^3)	L.O.I. @ 1000^{0}C (% WT)	CaO	Fe_2O_3	Al_2O_3	Na_2O	MgO	K_2O	SiO_2	TiO_2	Mn_3O_4	P_2O_5	SO_3
Vicron 45-3	Ca CO_3	9.8	2.706	42.49	55.64	0.08	0.03	0.01	0.54	<0.01	0.20	<0.01	NA	0.01	0.02
RWK Limestone	Ca CO_3	20.0	NA	NA	54.42	0.12	0.15	NA	0.58	NA	1.36	NA	0.03	NA	NA
RWK Hydrated Lime (Phase I)	Ca $(OH)_2$	4.0	NA	NA	72.86	0.17	0.21	NA	0.63	NA	0.43	NA	0.02	NA	NA
RWK Hydrated Lime (Phase II)	Ca $(OH)_2$	4.4	2.249	25.18	74.08	0.13	0.18	0.01	0.72	0.02	0.42	0.01	NA	0.03	0.07

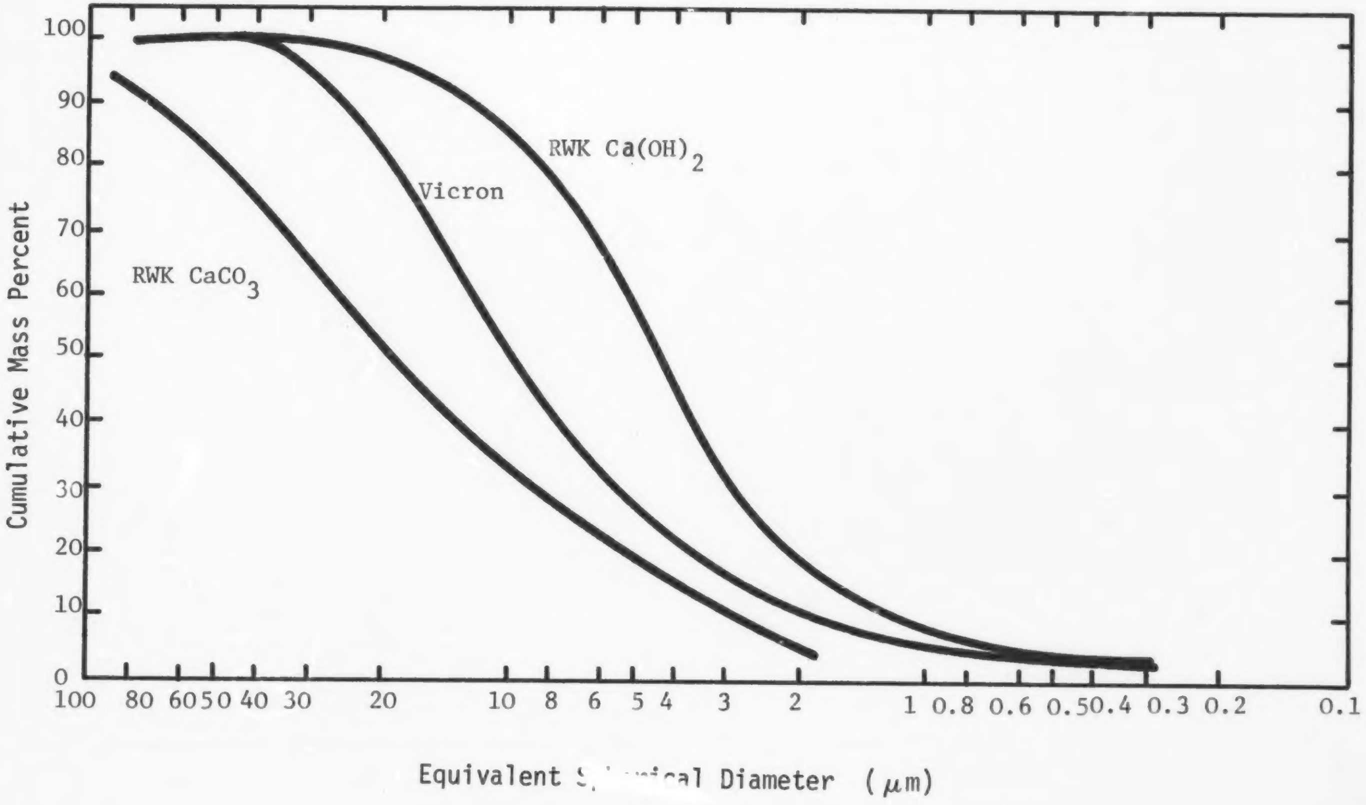


Figure 3-8. Comparison of sorbent size distributions.

3.3 Test Facilities

The Steinmüller SM burners were tested in the EPA LWS test facility at EER's test site. The LWS is a 150 x 10^6 Btu/hr combustor, shown schematically in Figure 3-9. The furnace is designed to match the size and geometry of a large industrial or small utility single wall-fired boiler. The LWS characteristics are detailed in Table 3-6. Specific instrumentation and process equipment utilized during testing were operated and maintained in accordance with the Quality Assurance Program Plan (QAPP).

3.4 Test Procedures

A parametric test matrix was designed to provide a comprehensive evaluation of the SM burners. The tests were divided into two major series - burner optimization, for low NO_x emissions and stability, and SO_x reduction characterization with sorbent injection. Table 3-7 lists the burner parameters tested during each series. Specific tests each day were conducted to most efficiently characterize the burner performance.

Procedures applied to the tests were grouped into the following formats:

- Standard (Routine) Measurements Format - routine measurements applied to all test conditions (Table 3-8).
- Detailed Measurement Format - additional measurements applied to specific test conditions to more fully characterize performance (Table 3-9).

Test procedures utilized were in accordance with guidelines set by the QAPP. Specific quality assurance activities are discussed in Appendix A.

Exceptions, additions, or modifications to the QAPP of specific test procedures utilized included:

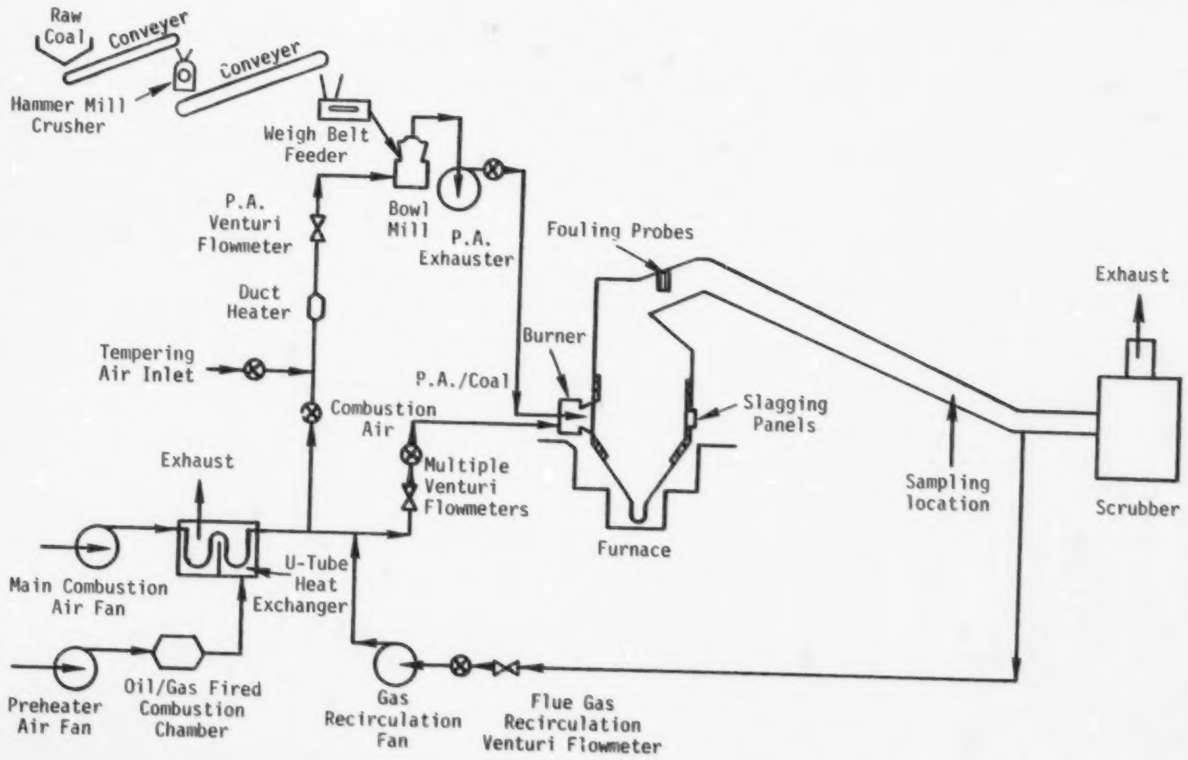

Raw Coal
Conveyer
Hammer Mill Crusher
Conveyer
Weigh Belt Feeder
Bowl Mill
P.A. Exhauster
P.A. Venturi Flowmeter
Duct Heater
Tempering Air Inlet
Combustion Air
P.A./Coal
Burner
Fouling Probes
Slagging Panels
Furnace
Multiple Venturi Flowmeters
Exhaust
Main Combustion Air Fan
U-Tube Heat Exchanger
Preheater Air Fan
Oil/Gas Fired Combustion Chamber
Gas Recirculation Fan
Flue Gas Recirculation Venturi Flowmeter
Sampling location
Exhaust
Scrubber

Figure 3-9. Large watertube boiler simulator system schematic.

TABLE 3-6 LWS FURNACE CHARACTERISTICS

Parameter			Specification
Firing			
	Configuration	Primary	Single Wall
		Optional	Opposed or Corner
	Firing Rate	Minimum	50×10^6 Btu/hr (Practical Limit)
		Maximum	150×10^6 Btu/hr
Dimensions			
	Firing Depth		22 ft
	Width		16 ft
	Rear Wall Height		20 ft
	Knuckle-to-Nose Height		27.5 ft
	Nose Angle		37° (From Horizontal)
	Hopper Angle		52° (From Horizontal)
	Furnace Height Above Ground Level		35.7 ft
	Total Vertical Height		50.5 ft (Pit-to-Top)
Cooled Surface Area			
	Burner Zone		704 ft^2
	Total Furnace		1951 ft^2
Volume			
	Burner Zone		3520 ft^3
	Total Furnace		11,544 ft^3 (to Nose)
Insulation			All Sidewalls Knuckle up to 16 ft
Cooling			Spray-Cooled on All Surfaces

TABLE 3-7. TEST SERIES FOR SM BURNERS

Test Series	Objective	Parameters Tested
Burner Optimization/ Characterization	NO_x characterization and establish overall burner performance with respect to efficiency and stability.	1) Burner settings 2) Excess air 3) Staging 4) Tertiary location 5) Tertiary velocity 6) Primary configuration 7) Turndown capability 8) Fuel
SO_x Evaluation at Optimum Burner Conditions	Establish SO_x reduction using sorbent injection.	1) Sorbent type 2) Sorbent injection location 3) Sorbent feed rate

TABLE 3-8. STANDARD MEASUREMENT FORMAT

Inputs			Outputs		
Parameter	Method	Record	Parameter	Method	Record
Burner Settings	Manual	Manual	Flame Characteristics	Manual and Color Video	Manual
Air Flow Rates	Venturi Meter	Computer	Combustion Products:		
Air Temperature	Thermocouples (Type K)	Computer	O_2	Beckman 755, Paramagnetic	Computer and Strip Chart Recorder
Coal Flow Rate	Weigh Belt Feeder and Calculation from Coal Composition, Air Flow and Excess O_2	Computer	CO	Anarad AR 500R, NDIR	
			CO_2	Anarad AR 500R, NDIR	
Sorbent Injection Location	Manual	Manual	NO_x	TECO 10 AR, Chemiluminescent	
Sorbent Flow Rate	Volumetric Feeder	Manual	SO_2	DuPont 400, NDUV	
			Burner/Furnace Pressures	Magnehelics (Dwyer 2000 series)	Manual
			Furnace Temperatures	Thermocouples (Type K)	Computer

TABLE 3-9. DETAILED MEASUREMENT FORMAT

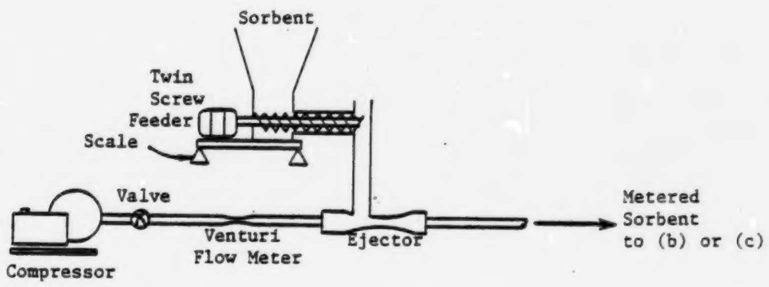
Inputs		Outputs	
Parameter	Method	Parameter	Method
Coal Composition	Ultimate and proximate analysis - ASTM D3172 and D3176	Particulate Matter:	
		Composition	• Ultimate analysis - ASTM D3176
Coal Size Distribution	ASTM Method D197		
Sorbent Composition	ASTM Method D3682		• Elemental Ash - ASTM D3682
Sorbent Size Distribution	X-Ray Sedimentation	Size Distribution	• X-Ray sedimentation
		Flue Gas Sulfur Species:	
		SO_2	• Continuous monitor - DuPont 400 NDUV
			• EPA Method 6
		SO_3	• Controlled Condensation and Method 8

1) Sorbent injection system
2) High volume grab sampler
3) SO_2 sample system
4) Particulate mass loading

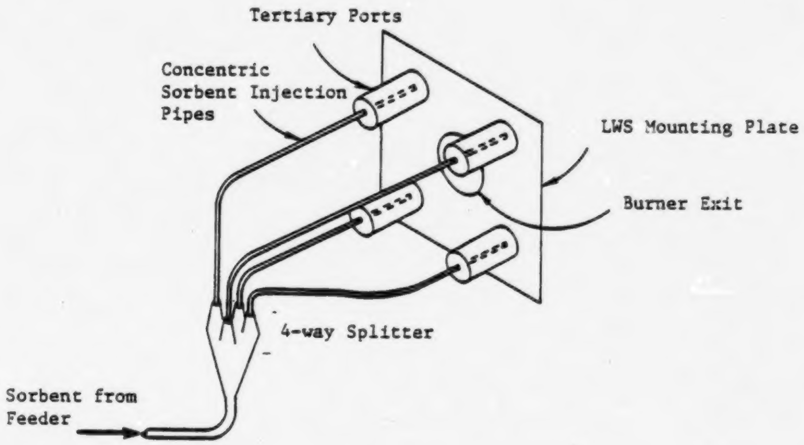
The sorbent injection system, as shown is Figure 3-10 consists of a volumetric feeder, hopper, and air injection system. The feeder is a commercial volumetric twin-screw feeder manufactured by K-tron. The air injection system consists of a compressor, a venturi meter to monitor flow, and ejector. The sorbent was injected at two locations, directly at the outlet of the pulverizer or through a four-way splitter into a set of tertiary air ports. Sorbent was injected through pipes located on the axis of each tertiary air port. The injection nozzles had an internal diameter of 32.5 mm. The volumetric feeder was calibrated with each sorbent material to determine the rate of sorbent flow for a range of feeder speeds. In addition, during each injection test, direct feed rate was determined by mounting the feeder and hopper assembly on a scale to determine weight change over time.

The high-volume sampler used to collect particulate or fly ash samples is shown in Figure 3-11. A large exhaust gas sample from the center of the LWS exhaust duct is drawn into the baghouse through an insulated flexible duct. The particulate is collected on the bags, which are intermittently pulsed with compressed air to force the particulate matter sample into the collection container.

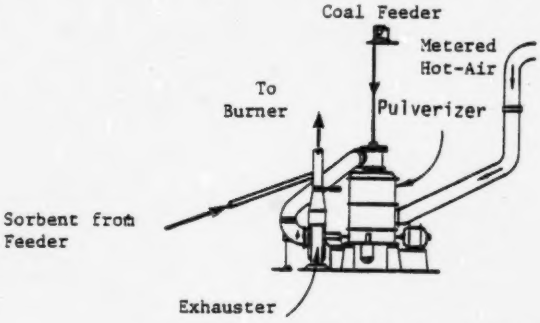
The SO_2 sample system, shown in Figure 3-12, was utilized during Phase II testing. A phase discrimination probe is used. This probe is designed to effectively separate particulate matter in the central stream of sample gas from the sample that passes through the SO_2 analyzer. This separation prevents the SO_2 scrubbing effect caused by particulate in the gas stream when sorbent is present. The sample passes through a heated sample line, into a heated filter, and into a commercial permeation tube dryer installed upstream of the instrument, effectively removing the moisture from the sample gas. Therefore, the SO_2 measurement is determined on a dry basis. The


Sorbent
Twin
Screw
Feeder
Scale
Valve
Compressor
Venturi
Flow Meter
Ejector
Metered
Sorbent
to (b) or (c)

a) Sorbent Feed System


Tertiary Ports
Concentric
Sorbent Injection
Pipes
LWS Mounting Plate
Burner Exit
4-way Splitter
Sorbent from
Feeder

b) Sorbent Injection through
Tertiary Air Ports


Coal Feeder
Metered
Hot-Air
To
Burner
Pulverizer
Sorbent from
Feeder
Exhauster

c) Sorbent Injection with Coal

Figure 3-10. Schematic representation of sorbent injection system.

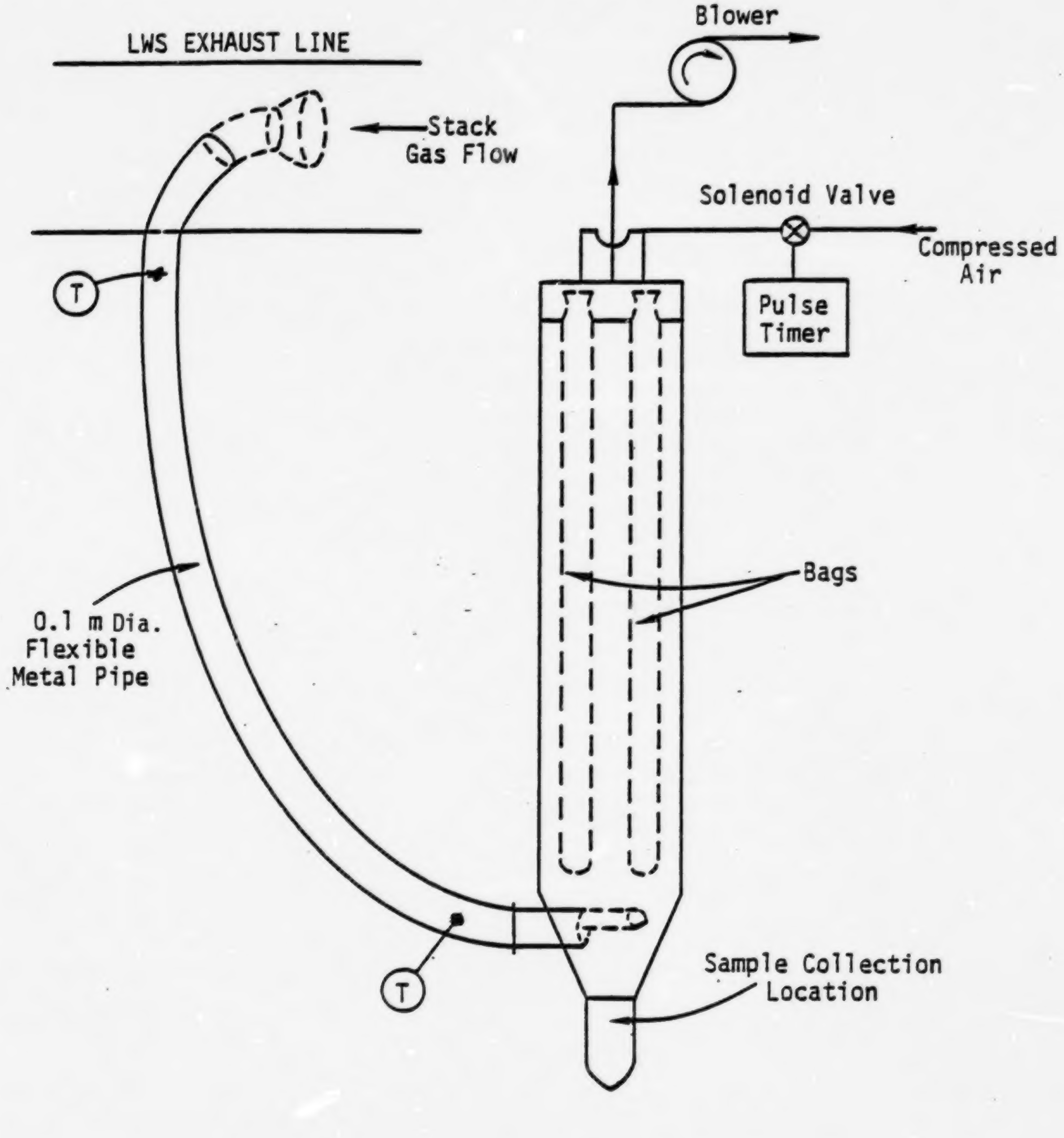
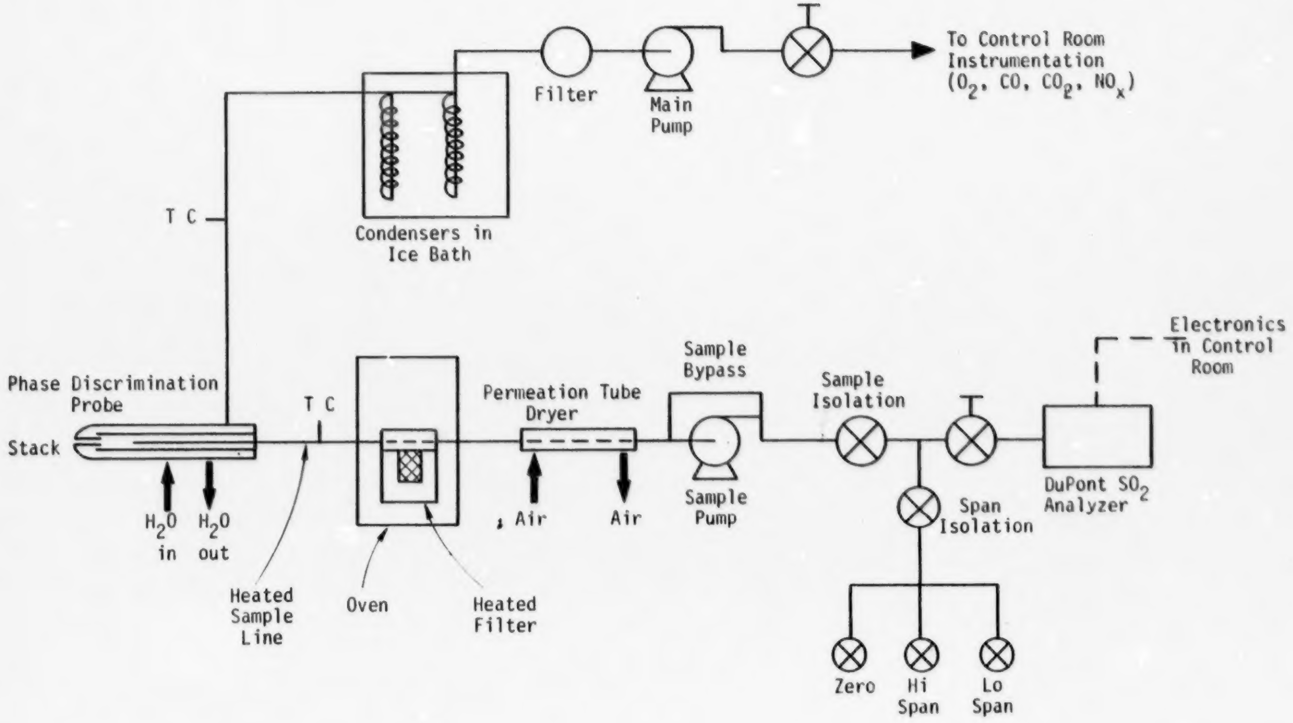

LWS EXHAUST LINE
Blower
Stack Gas Flow
Solenoid Valve
Compressed Air
Pulse Timer
T
Bags
0.1 m Dia. Flexible Metal Pipe
T
Sample Collection Location

Figure 3-11. High volume sampler.



To Control Room
Instrumentation
(O_2, CO, CO_2, NO_x)
Filter
Main
Pump
T C
Condensers in
Ice Bath
Electronics
In Control
Room
Phase Discrimination
Probe
Stack
T C
Permeation Tube
Dryer
Sample
Bypass
Sample
Isolation
H_2O
in
H_2O
out
Air
Air
Sample
Pump
Span
Isolation
DuPont SO_2
Analyzer
Heated
Sample
Line
Oven
Heated
Filter
Zero
Hi
Span
Lo
Span

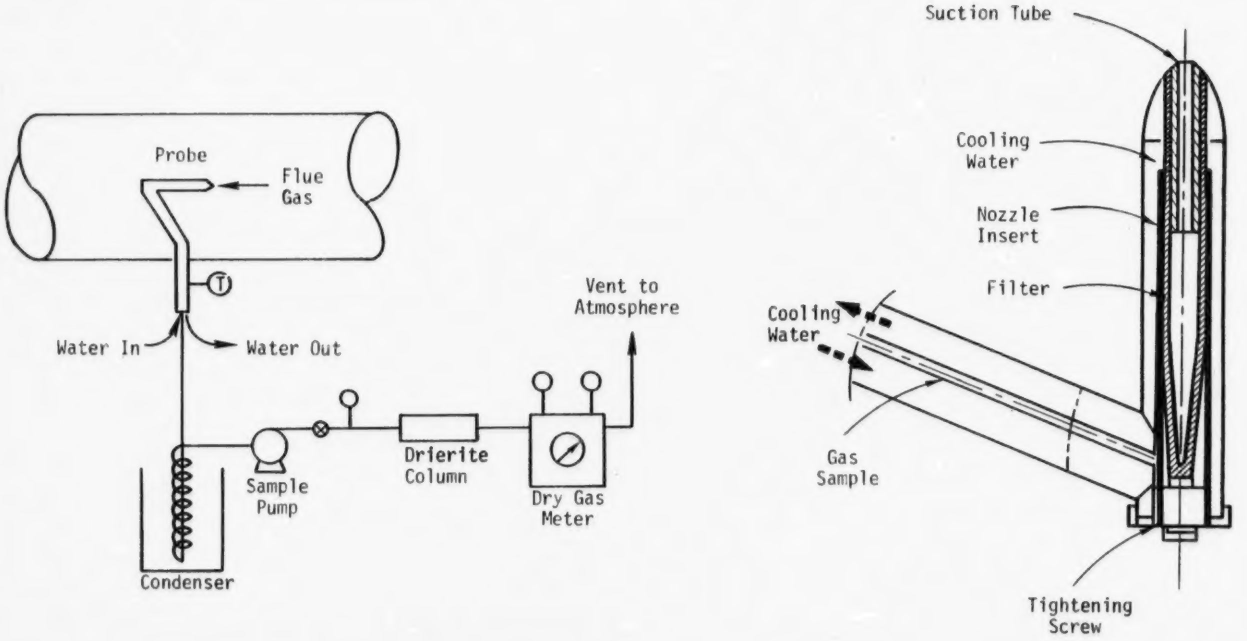
Figure 3-12. Schematic for LWS sampling system.

remaining central stream of the gas sample passes through a condenser and delivers a sample for the remaining instruments. The sample system used during the Phase I tests was identical except for the SO_2 being measured on a wet basis. This was accomplished by maintaining the entire SO_2 sample system above the dew point of SO_2 to prevent any condensation. The permeation tube dryer was not included in the Phase I test program system, therefore, SO_2 was measured on a wet basis. To correlate the SO_2 concentrations between the two test phases, it is necessary to correct the concentrations measured wet (Phase I) to a dry basis by using the following relationship:

$$\text{ppm (dry)} = \text{ppm (wet)} \times \frac{100\%}{(100\% - \%\text{ moisture in stack gas})}$$

Although, correction for moisture changes the absolute concentration of SO_2, there is no change in percent reduction due to sorbent injection, since all calculations were determined on a consistent basis, either wet or dry for each testing phase.

Particulate mass loadings were measured by a water-cooled solids probe with a sintered metal filter as shown in Figure 3-13. A pretreated (baked in an oven at 100°C for 1 hour and desiccated for at least 12 hours) and preweighed filter is placed in the filter holder of the probe. A velocity measurement with an S-type pitot probe is made at the sampling point in the stack prior to sampling. The stack gas temperature, moisture content, and velocity measurement dictate the sampling rate for isokinetic solids sampling. After sampling times of about 5-10 minutes, the filter is removed and weighed after drying. The weight gain of the filter and the dry gas volume sampled are used to calculate the solids mass loading.


Probe
Flue Gas
Water In
Water Out
T
Condenser
Sample Pump
Drierite Column
Dry Gas Meter
Vent to Atmosphere
Suction Tube
Cooling Water
Nozzle Insert
Filter
Cooling Water
Gas Sample
Tightening Screw

a) Sampling System.

b) In-situ Filter/Nozzle Probe.

Figure 3-13. Solids probe and sampling train.

4.0 BURNER PERFORMANCE AND NO_x EMISSIONS

Two basic Steinmüller SM burner designs were evaluated in two separate test series. The performance of the SM burners was characterized in terms of NO_x emissions, combustion efficiency, range of operation, flame stability, and flame shape with each of the three coals described in section 3.2. The Utah coal was used to optimize the SM burner performance in the LWS, providing a basis for comparison with other low-NO_x and commercial burners tested in the LWS. The first phase of LWS testing characterized the performance of the SM burner design fired in the Weiher III boiler. Testing of the Weiher SM burner with the Saar coal normally used at that boiler establishes a link between the LWS test results and an operating boiler. This link permits the evaluation of the applicability of the advanced design features tested during the second phase to field units. The third coal, from Indiana, was primarily tested as part of the SO_2 reduction with sorbent injection, but data were also obtained regarding burner performance.

4.1 Weiher SM Burner

The initial characterization of the SM burner design used at the Weiher III boiler in the LWS was conducted with Utah coal. Performance under staged conditions, at a burner zone stoichiometry (SR_B) of about 86 percent theoretical air (T.A.), was optimized using the single adjustable burner parameter available, the secondary air swirler position. The effect of the swirler is summarized in Figure 4-1. The position of the swirl vane mechanism was varied from 2 to 5, as defined in section 3.1. The position of the swirler had little effect as the position was changed from 4 to 2; however, NO_x emissions increased to about 550 ppm* at the maximum swirl position of 5. This behavior is typical of that observed in previous tests of the SM burner and can be expected because of the low swirl generation of the fixed blade impeller type device used in the SM burner. No apparent change in the flame shape and length was observed when swirl was varied from settings of 2 to 5.

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*Note that all gas concentrations in this report are corrected to 0 percent O_2.

Nominal Test Conditions:
Utah Coal
Firing Rate = 101.6±4.2 x 10^6 Btu/hr
Btu/hr
SR_B = 87 ±1.8% TA
SR_T = 128 ± 4.4% TA

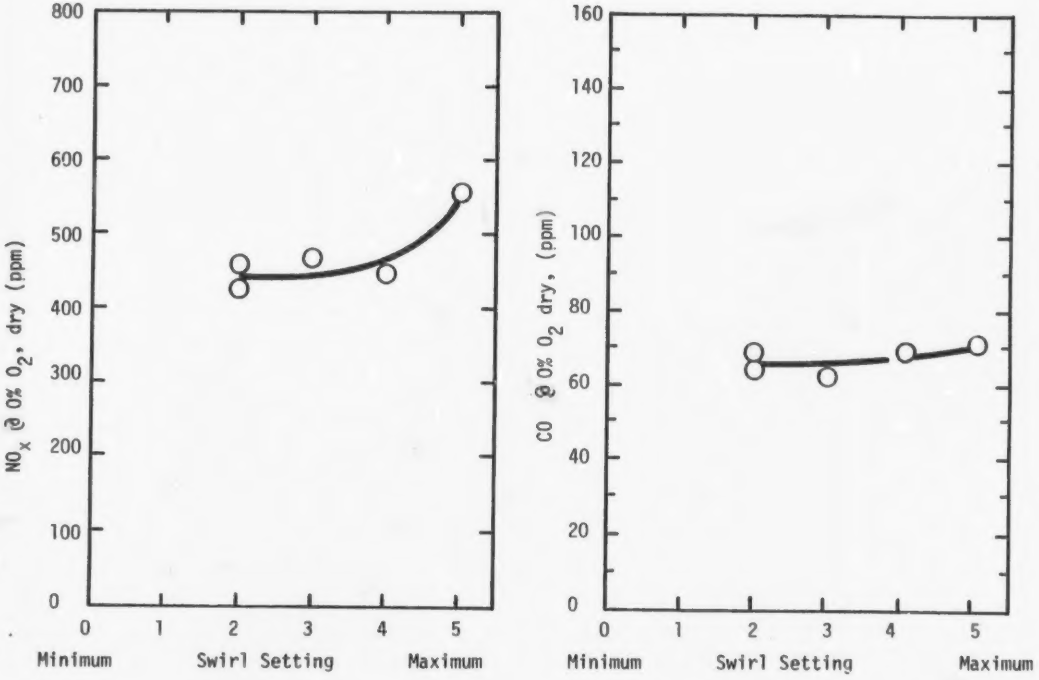


Figure 4-1. Effect of swirl on Weiher SM burner performance.

For stable conditions, flame shapes were similar with the ignition point at the burner exit and flame length of about 21 feet. For very low swirl settings, less than 2, the flames became progressively unstable and detached from the exit. The swirl setting chosen to be optimum was a position of 4, which provided a wide stability margin for most test conditions.

Emissions from distributed mixing type burners, such as the SM burner, are normally sensitive to both the degree of staging, usually given in terms of burner zone stoichiometry (SR_B), and excess air, or overall stoichiometry (SR_T). The effect of staging on emissions from the Weiher SM burner at full load is summarized in Figure 4-2. NO_x emissions decrease similarly for each coal tested as combustion air is diverted to the tertiary ports to decrease the SR_B. The rate of decrease in NO_x emissions ranges from about 5 to 7.5 ppm per percent theoretical air change in SR_B for Utah and Indiana coals, respectively. Emissions at SR_B = 80 percent were about 415, 450, and 510 ppm for Utah, Saar, and Indiana coals, respectively. The flame produced while firing the Indiana coal had a standoff from the exit of about one foot, while the flames from the Saar and Utah coal were attached at the burner exit. This lifted flame with the Indiana coal allows some premixing to occur and thus results in increased NO_x formation. The Weiher SM burner could be operated with an SR_B less than 70 percent T.A. for each coal. Included in Figure 4-2 are data, shown as dotted symbols, for Utah and Saar coals at firing rates less than the operating conditions shown in the figure. These data were not included in the regression analyses that fit lines to the data, but do serve to show that deep staging could be achieved with this burner and also verify the derived trends. Combustion efficiency as indicated by CO emissions was generally good. CO emissions were in a range from 50 to 60 ppm for $SR_B > 80$ percent T.A. Increasing staging to $SR_B < 80$ percent generally resulted in increased CO levels.

The effect of excess air on emissions from the SM burner under staged conditions is shown in Figure 4-3 for all three test fuels. NO_x emissions were very sensitive to excess air for the conditions listed on the figure. The slope of the NO_x emissions curves range from about 9.2 to 15 ppm per percent theoretical air. NO_x emissions were lowest for the Utah coal and

Nominal Conditions:

Coal	Firing Rate (10^6 Btu/hr)	SR_T(%TA)
○ Utah	102.6±2.1	125±1.8
■ Saar	104.4±1.0	125±1.7
△ Indiana	100.8±0.8	127±1.4

Note: Dotted symbols are less than normal firing rates. Data was not included in analysis but shown for completeness.

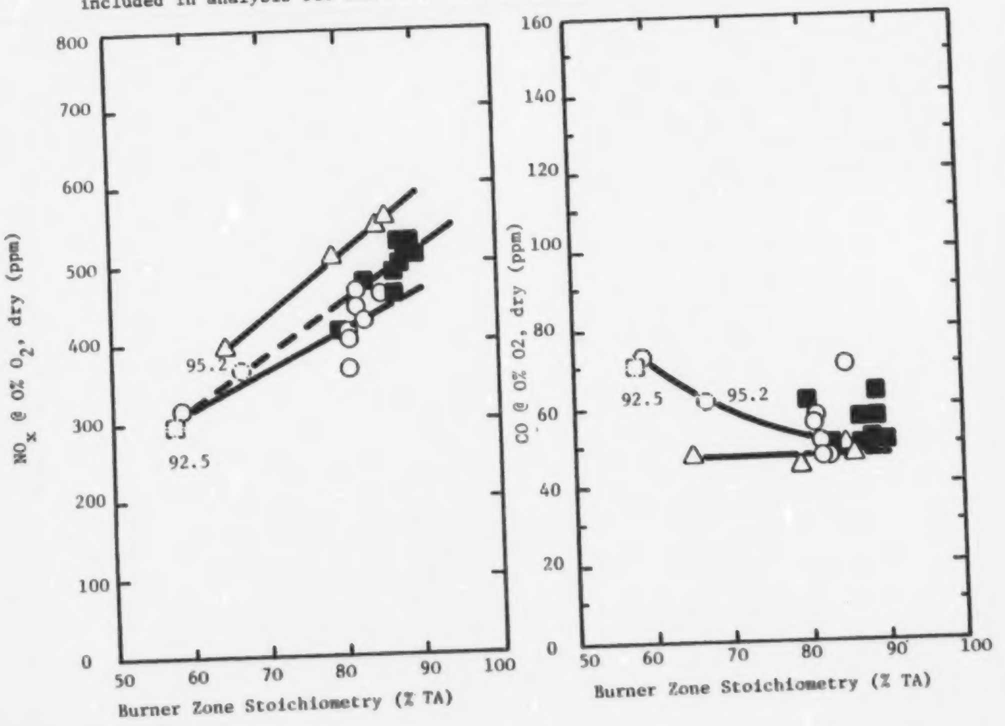


Figure 4-2. Effect of burner zone stoichiometry on emissions from the Weiher SM burner.

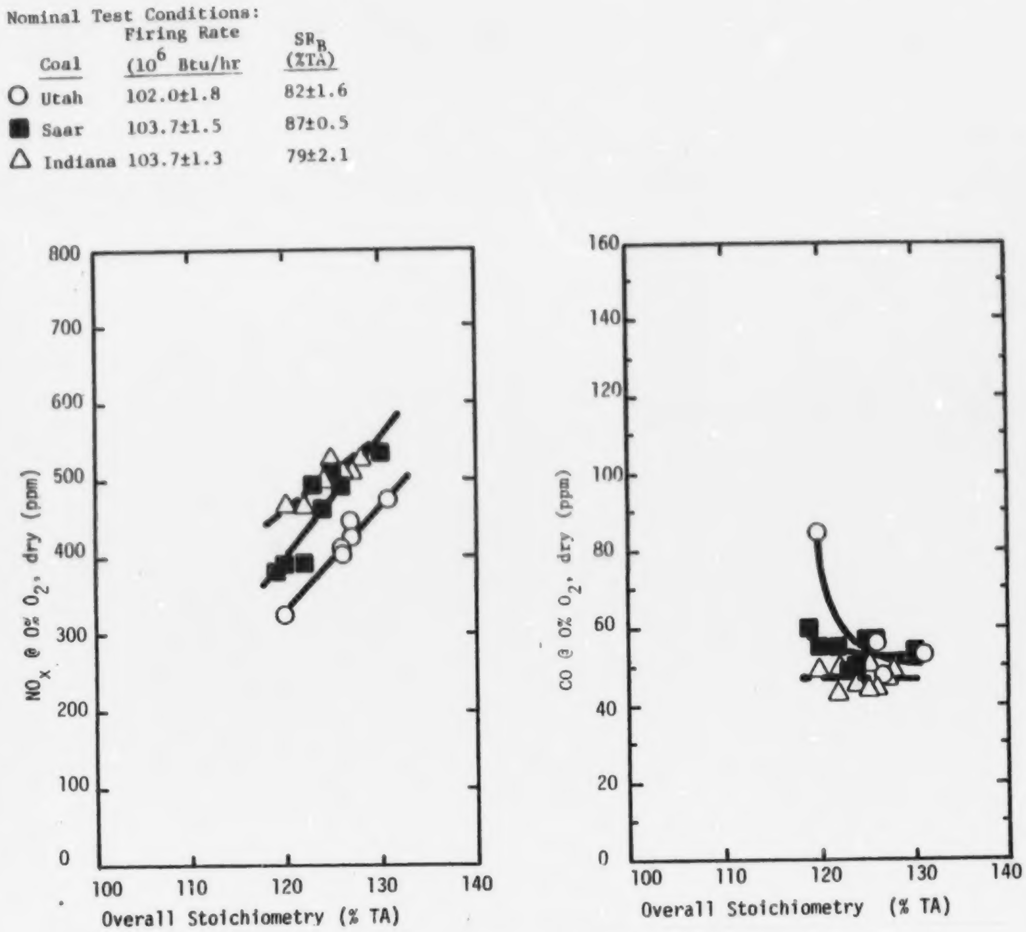


Figure 4-3. Effect of excess air on emissions from the Weiher SM burner.

highest for the Indiana coal over the entire range shown. At an SR_T of 125 percent T.A., the Steinmüller design point, NO_x levels were 400, 475, and 510 ppm for the Utah, Saar, and Indiana coals, respectively. CO emissions were constant for the Indiana and Saar coals over the test range, with average levels of 47 and 55 ppm, respectively. For the Utah coal, however, CO emissions increased substantially to about 85 ppm at an SR_T of 120 percent. Above 20 percent excess air, CO levels were between 45 to 55 ppm for the Utah coal.

The Weiher SM burner was also evaluated at reduced load to determine its range of operation. Effects of firing rate on burner performance are shown in Figure 4-4. For unstaged operation, NO_x emissions decreased at a rate of about 4 ppm/10^6 Btu/hr for both Saar and Utah coals. Combustion efficiency, as measured by CO emissions, decreased for both coals. However, the CO emissions from the Saar coal increased to much higher levels, about 150 ppm compared to 90 ppm for the Utah coal at 50 x 10^6 Btu/hr. This is consistent with the poor burnout observed for the Saar coal at full load. Reducing load at staged conditions for Utah coal did not have a significant effect on NO_x emissions. As load was decreased at staged conditions, the flame front became progressively more detached even at the maximum swirl setting of 5. The flame detached from the exit because the swirl momentum decreased as air flow through the burner was reduced. The detached flame allows premixing to occur prior to ignition, resulting in NO_x emissions greater than would be expected with attached flames. CO emissions increased to 90 ppm as load was decreased from 100 x 10^6 to 45 x 10^6 Btu/hr. Since the staged and unstaged emissions are not significantly different at half load, Steinmuller adopted the procedure of progressively reducing the degree of staging with load. This method produces stable attached flames without compromising NO_x emissions. 4-4

Carbon burnout, based on fly ash composition, was relatively good for the two U.S. coals with carbon content in the fly ash ranging from 4.3 to 7.2 percent at nominal design point conditions (100 x 10^6 Btu/hr, SR_B = 80 percent T.A., SR_T = 125 percent T.A.). The Saar coal, however, had substantially higher levels of carbon in the fly ash. Ash samples from firing Saar

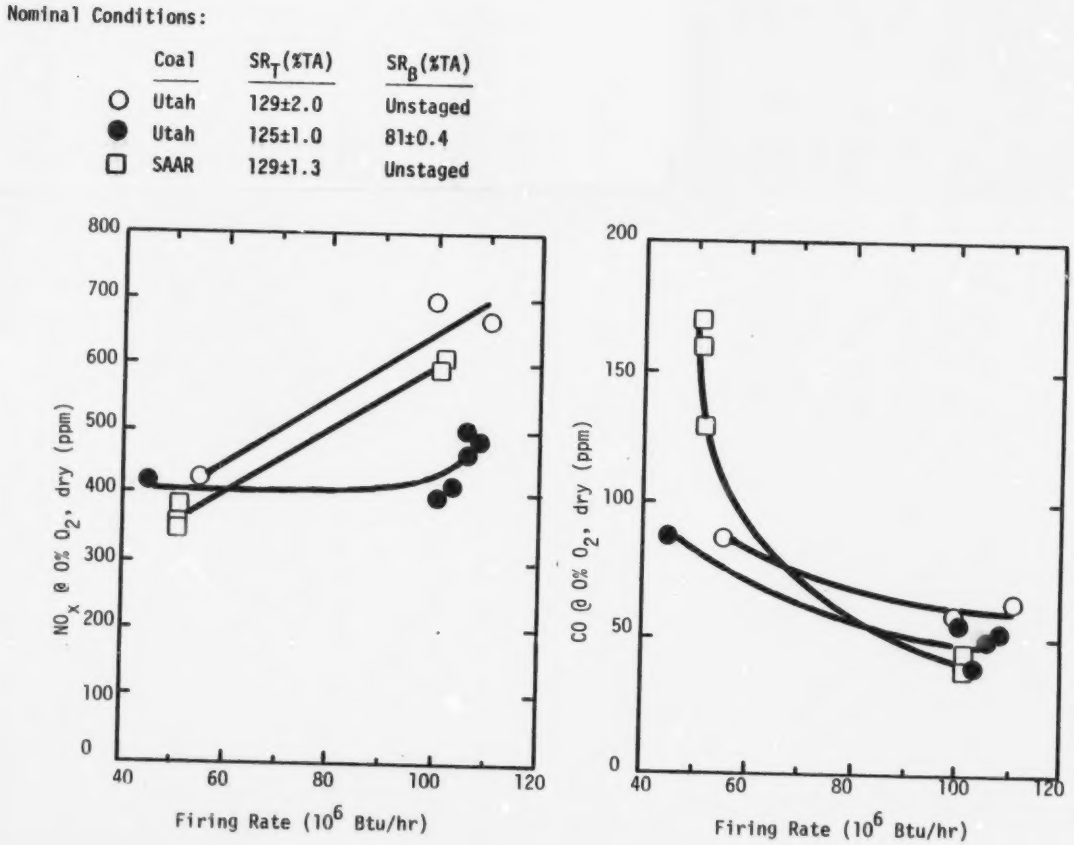


Figure 4-4. Effect of firing rate on Weiher SM burner performance.

coal at similar design point conditions contained 25 to 33 percent carbon. The ultimate and proximate analysis of the Saar coal are similar to the Utah and Indiana coals, which had no burnout problem. The petrographic data, discussed in Section 3.2, indicate that the Saar coal may have some characteristics, including plasticity and a high proportion of pseudovitrinite, which could result in poor burnout. The results of the thermogravimetric analysis (TGA) lend further evidence that the Saar coal may tend toward inefficient combustion, with the derivative thermogravimetric analysis (dTGA) indicating a considerable lag of about 100°C for the escape of volatiles compared to the other two coals. Coupled with these tendencies indicated by laboratory analysis is the relatively cold thermal environment of the LWS which may support poor burnout of the Saar coal.

4.2 Optimization of SM Burner Design

The second phase of tests evaluated several hardware modifications designed by Steinmüller to optimize the SM burner. These modifications, described in Section 3.1, included:

- Insert to increase secondary air velocity.
- Variable tertiary port location and velocity.
- Coal splitter insert to vary coal and primary air distribution.
- Venturi insert in annular coal nozzle to vary coal and primary air distribution.

The SM burner with the secondary air insert was used throughout the second phase of testing and this configuration is referred to as the SM-II burner in this report. Utah coal was used as the primary fuel for the optimization tests, with the Saar and Indiana coals fired at selected conditions to verify performance with a range of fuels. Burner performance was evaluated according to the following criteria:

- Low NO_x emissions.

- Low CO emissions over a wide range of excess air.

- High combustion efficiency indicated by low carbon content in the fly ash.

- Flame stability and acceptable flame length over a wide operating range.

4.2.1 SM-II Burner Performance with Secondary Air Insert

A brief series of unstaged tests using Utah coal was conducted with the SM-II burner. The burner was operated unstaged with the maximum swirl setting of 5 and the valve for the core air 45° open. These settings were not necessarily optimum for staged operation, but they were used based on results from the tests with the Weiher SM burner which required a swirl setting close to the maximum point. The results from the unstaged tests are shown in Figure 4-5. NO_x emissions increased at a rate of about 12 ppm per percent T.A. change in excess air. At the Steinmüller design point of SR_T equal to 125 percent, NO_x was 810 ppm. CO levels remained low over the entire range of excess air, with an average of 46 ppm. The flame remained stable with an ignition point at the burner exit and lengths of approximately 14 to 16 feet.

Staged optimization of the SM-II burner, using the inner tertiary ports with the design point (SR_B = 80 percent T.A. and SR_T = 125 percent T.A.) velocity of 110 ft/sec, was conducted with Utah coal. The two adjustable burner parameters available were swirl setting and core air flow. The effect of swirl on burner performance is summarized in Figure 4-6. At the Steinmüller full load design point conditions, swirl vane position had negligible effect on emissions. However, decreasing swirl resulted in progressively increasing flame length and detachment from the throat. The optimum condition was determined to be a swirl setting of 4.5, close to maximum swirl. This position produced the most stable flame and allowed the widest operating range.

Nominal conditions

Swirl Setting = 5
Core Valve = 45° Open
Firing Rate = 99.5±1.6 x 10^6 Btu/hr

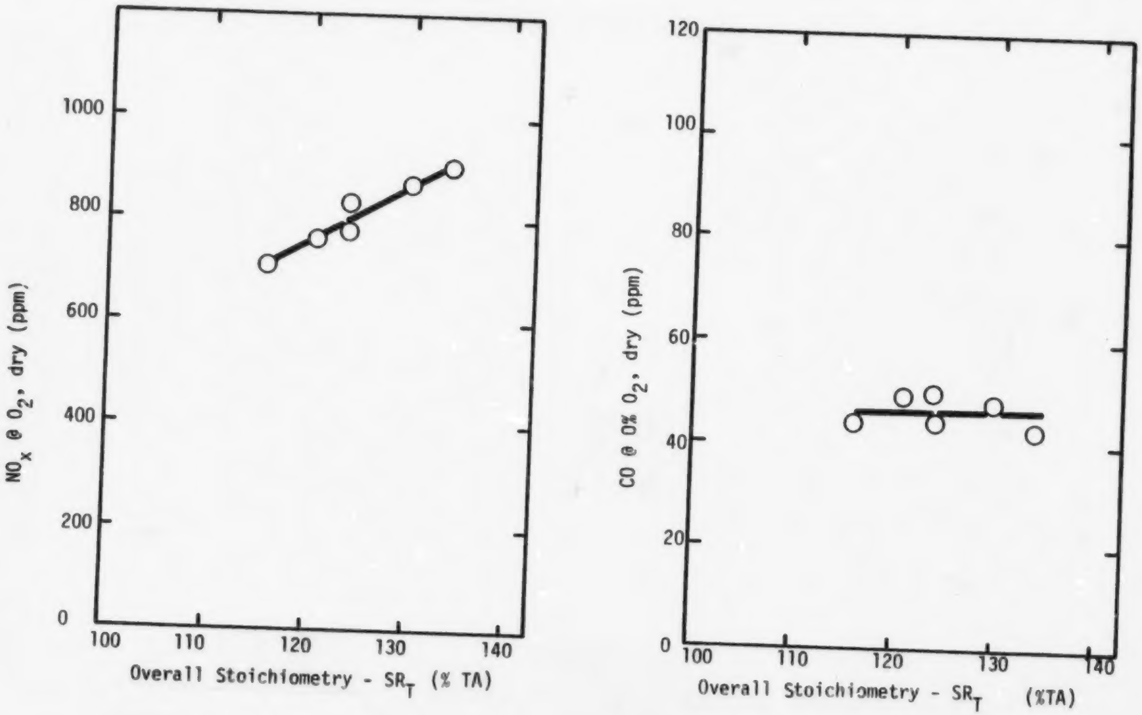
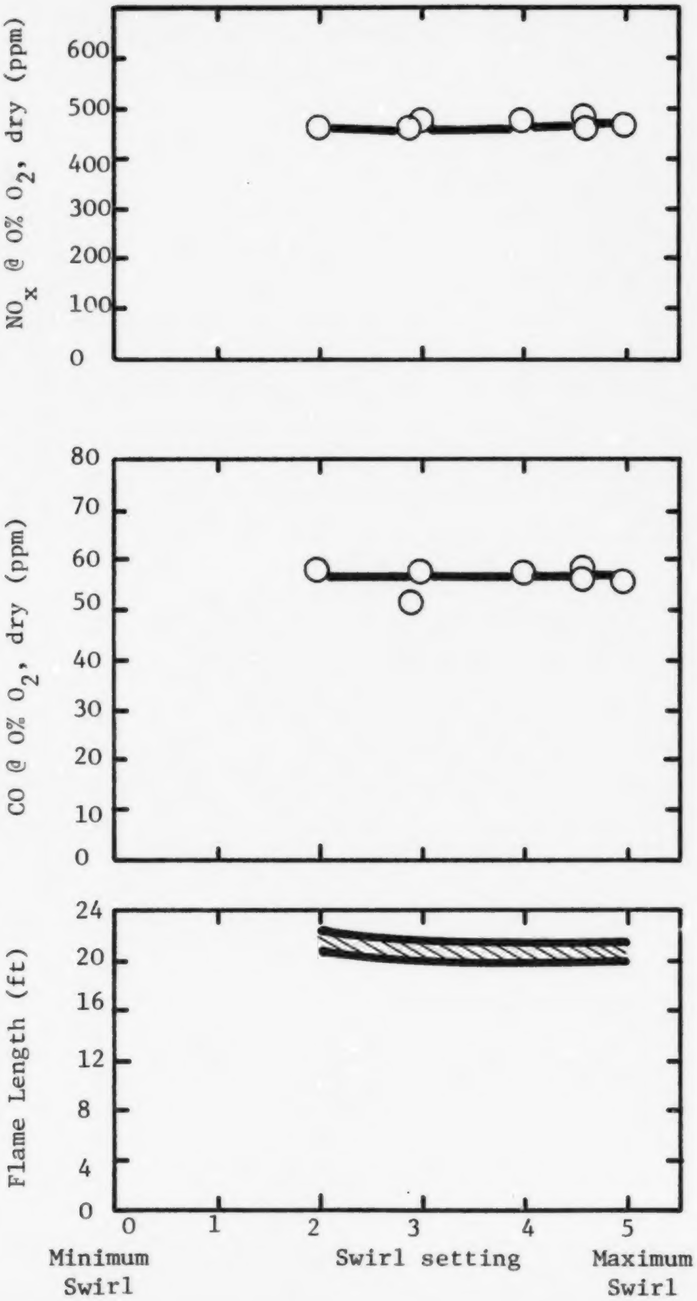


Figure 4-5. Unstaged SM-II burner performance with secondary air insert.



Nominal Conditions

Coal = Utah
Firing Rate =
101.2±0.8 x 10^6 Btu/hr
SR_B = 80.8±1.0% TA
SR_T = 126±1.0% TA
Core Valve = 0^o Open

Figure 4-6. Effect of swirl on SM-II staged performance.

Core air flow was also evaluated as an adjustable parameter. Core air is generally increased only for startup with oil igniters. Normal practice for Steinmüller is to operate SM burners while firing coal with only a small amount of air leaking past the core air valve. The low flow through the large core passage produces bluff body recirculation, which is the principal stabilizing device for the SM burners. During these tests, core air flow was varied with the position of the core valve. Nominal flows for each core valve position are listed below:

Valve Position (° Open)	Air Flow (scfm)
0	144
45	900
90	1100

Increasing core air flow generally decreased NO_x emissions with no significant impact on the measured CO, as can be seen in Figure 4-7. The trends in NO_x emissions are similar for each of the four swirl settings tested. For the case of lowest swirl, position 2.9, the effect of core air on CO was greatest, yielding an increase of almost 10 ppm. Flame standoff, or detachment from the throat, decreased slightly as the core air flow was increased from 144 to 900 scfm. Increasing the core air to 1100 scfm produced a slightly longer flame as well as increasing standoff to more than 12 in. The best compromise of flame stability and emissions were achieved with a core air flow of 900 scfm, or a core valve position of 45° open.

The staging characteristics for the SM-II burner were evaluated for each of the three coals at the optimum burner settings and design point excess air (SR_T = 125 percent T.A.). The set of inner tertiary port and the larger diameter ports, the same configuration as the Weiher SM burner, were used for these tests. The data are summarized in Figure 4-8. The NO_x emissions trends for each coal are similar. NO_x emissions decreased from 810 ppm unstaged to about 435 ppm at an SR_B of 80 percent for Utah coal, a reduction of 46

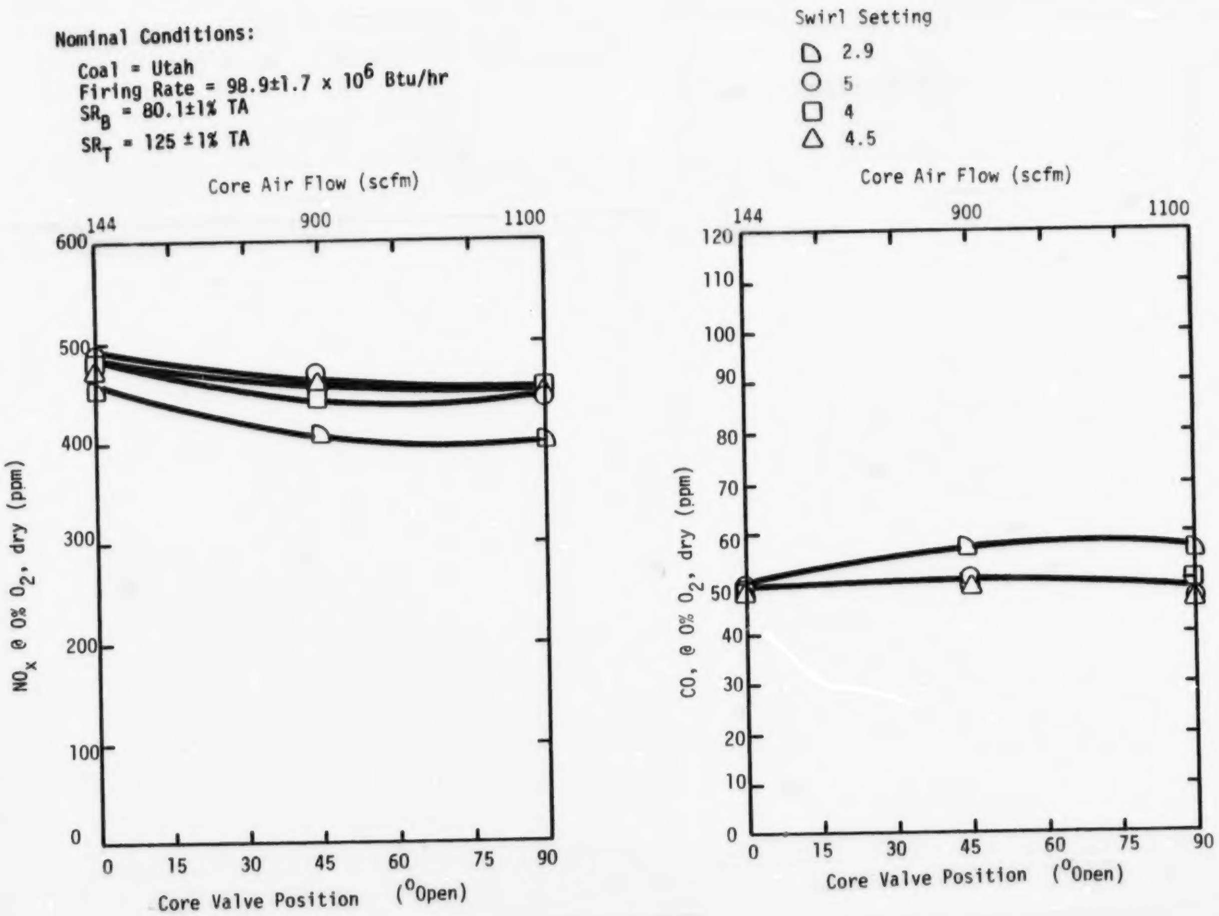


Figure 4-7. Effect of core air on SM-II staged performance.

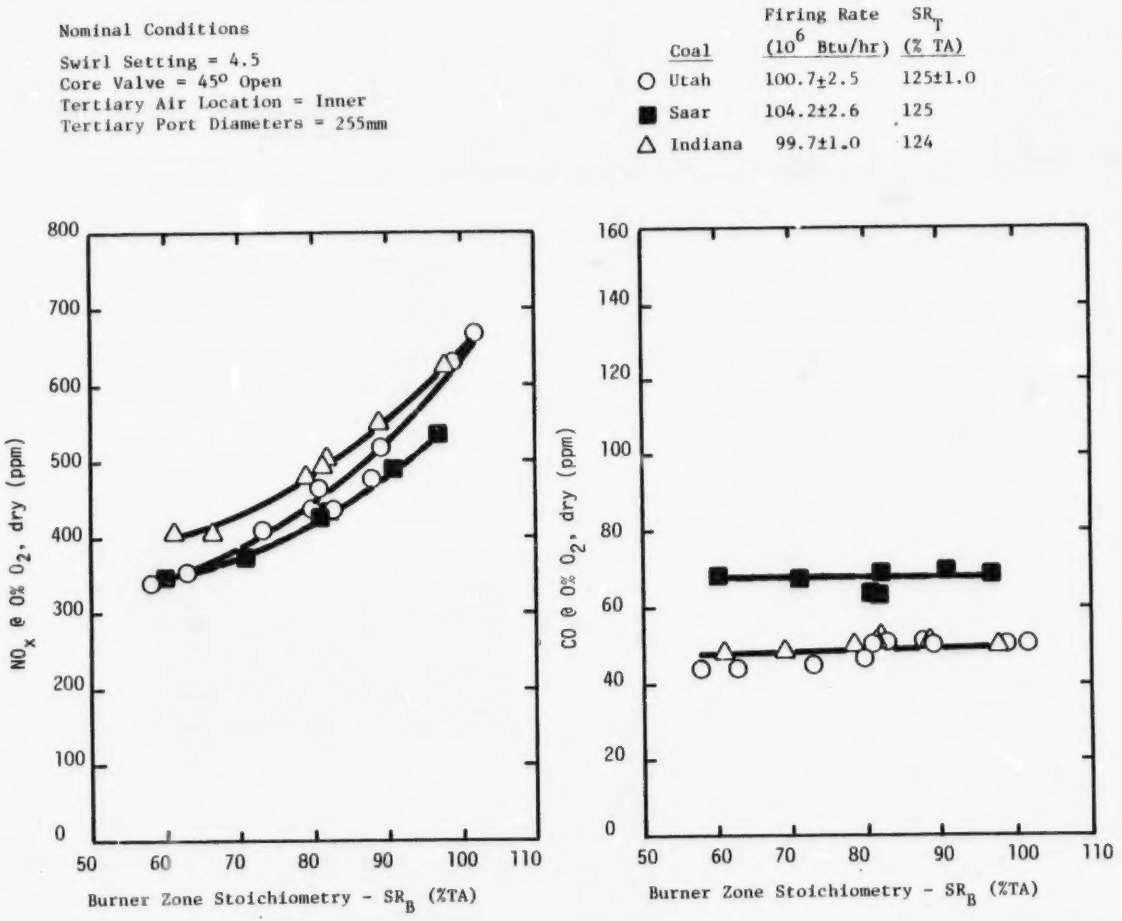


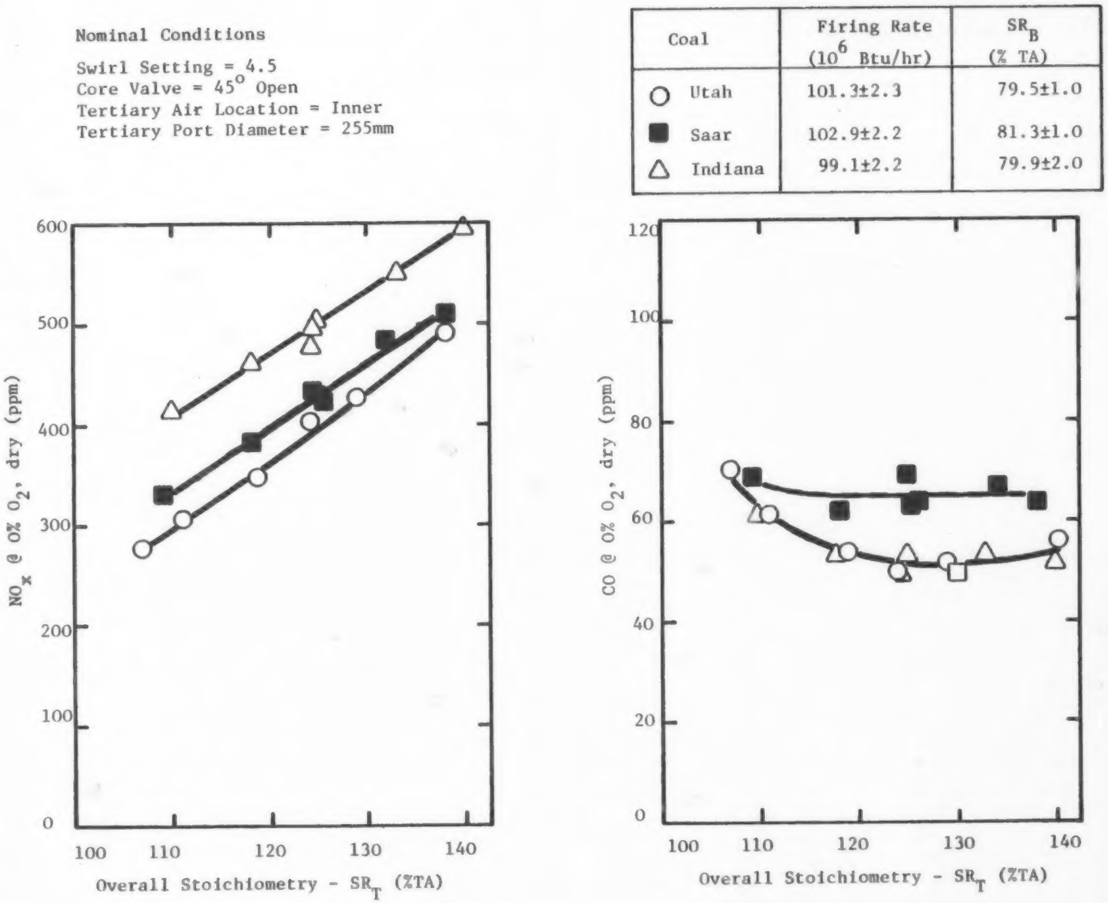
Figure 4-8. Effect of staging on SM-II performance.

percent. Reductions for the other two coals were similar. NO_x emissions at the design point SR_B were 425, 435, and 480 ppm for Saar, Utah, and Indiana coals, respectively. Flame stability was maintained down to an SR_B of about 60 percent. The flame length increased from about 16 ft unstaged to 21-22 ft at an SR_B of 80 percent. CO emissions were comparable for the Utah and Indiana coals and were not sensitive to staging for the entire test range. The Saar coal produced CO emissions averaging 68 ppm, approximately 20 ppm higher than for the other two coals. Combustion efficiency, as indicated by the carbon content of the fly ash, was similar for the two U.S. coal at design point staged conditions. Fly ash carbon was 7.8 and 9.1 percent for Utah and Indiana coals, respectively. Samples of Saar coal fly ash under similar conditions were much higher in carbon content, about 13.7 percent.

The effect of excess air on emissions from the SM-II burner is shown in Figure 4-9 for all three coals. Again, there is little difference between the NO_x emissions from the Saar and Utah coals, with the Indiana coal emissions being much higher. The rate of decrease in NO_x with decreasing excess air for the three coals was similar, ranging from 6 to 7.25 ppm/% T.A. for Saar and Utah coal, respectively. CO emissions remained relatively constant down to an excess air level of 10-12 percent. Below this point, often referred to as the "knee," CO emissions increased dramatically. Also, below this point flame stability decreased, preventing more precise characterization of this "knee."

4.2.2 Effect of Tertiary Air Parameters

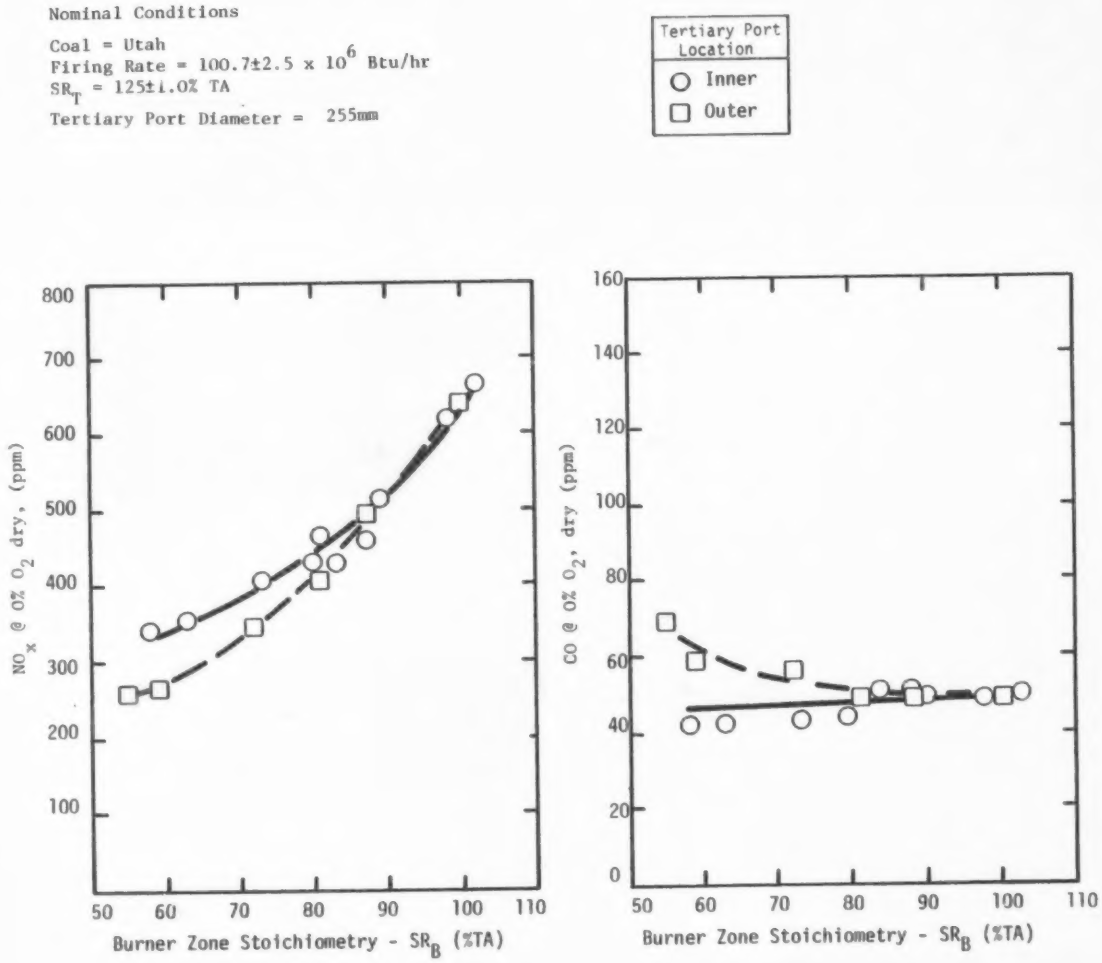
The tertiary air parameters evaluated with the SM-II burner were location and velocity. The test burner was equipped with two sets of tertiary ports, as described in Section 3.1, an inner set with a radial spacing of 1.25 throat diameters and an outer set with a radial spacing of 1.75 throat diameters. Inserts were fabricated that inceased tertiary air velocity by 50 percent. The evaluation of tertiary parameters was conducted with Utah coal at nominal full load conditions. The effect of tertiary port location with the larger diameter ports is summarized in Figure 4-10. The outer tertiary port configuration produced lower NO_x emissions, with the difference becoming


Nominal Conditions

Swirl Setting = 4.5
Core Valve = 45° Open
Tertiary Air Location = Inner
Tertiary Port Diameter = 255mm

Coal	Firing Rate (10^6 Btu/hr)	SR_B (% TA)
○ Utah	101.3±2.3	79.5±1.0
■ Saar	102.9±2.2	81.3±1.0
△ Indiana	99.1±2.2	79.9±2.0

Figure 4-9. Effect of excess air on SM-II performance.



Nominal Conditions

Coal = Utah
Firing Rate = 100.7±2.5 x 10^6 Btu/hr
SR_T = 125±1.0% TA
Tertiary Port Diameter = 255mm

Figure 4-10. Effect of tertiary port location on SM-II performance.

greater at lower burner zone stoichiometry. At the design point SR_B of 80 percent, NO_x emissions were about 440 ppm and 410 ppm for the inner and outer ports, respectively. This difference increased to 275 ppm for the outer ports and 335 ppm for the inner ports at an SR_B of 60 percent. As staging is increased, more air is diverted to the tertiary ports, thus increasing the velocity of the air. The lower NO_x with the outer ports is primarily a result of the delayed mixing of tertiary air with the primary combustion zone due to distance of the ports from the burner. This effect is amplified at lower burner zone stoichiometries as the tertiary air velocity increases, injecting the tertiary jet further into the furnace.

Similar effects on staged operation of the SM-II burner are shown in Figure 4-11 with the smaller diameter ports. For both port locations, the higher tertiary air velocity resulting from the smaller ports produced lower NO_x emissions. Again the difference in port location becomes greater at lower burner zone stoichiometry. The configuration with the smaller ports at the outer location produced the lowest NO_x emissions, 375 ppm at the design point (SR_B = 80 percent T.A). CO emissions were slightly higher, about 10 ppm, for both the outer port location and the higher velocity case. Overall, the optimum ter-iary configuration was with the smaller diameter ports and the outer port location because of the lower NO_x formation with no significant effect on CO or combustion efficiency.

4.2.3 Coal Nozzle Design

Two coal nozzle devices described in section 3.1 were evaluated with the SM-II burner in addition to the basic annular coal nozzle. The first was a variable blockage device which split the coal stream near the end of the coal nozzle into four streams by blocking segments of the annulus. The device could block from 25 to 50 percent of the area of the coal annulus and, thus, this device also increases the primary air and fuel velocity. The other device was a venturi-shaped insert installed near the end of the coal annulus. The effect of these coal nozzle configurations on burner performance are compared with the baseline annular coal nozzle in Figure 4-12.

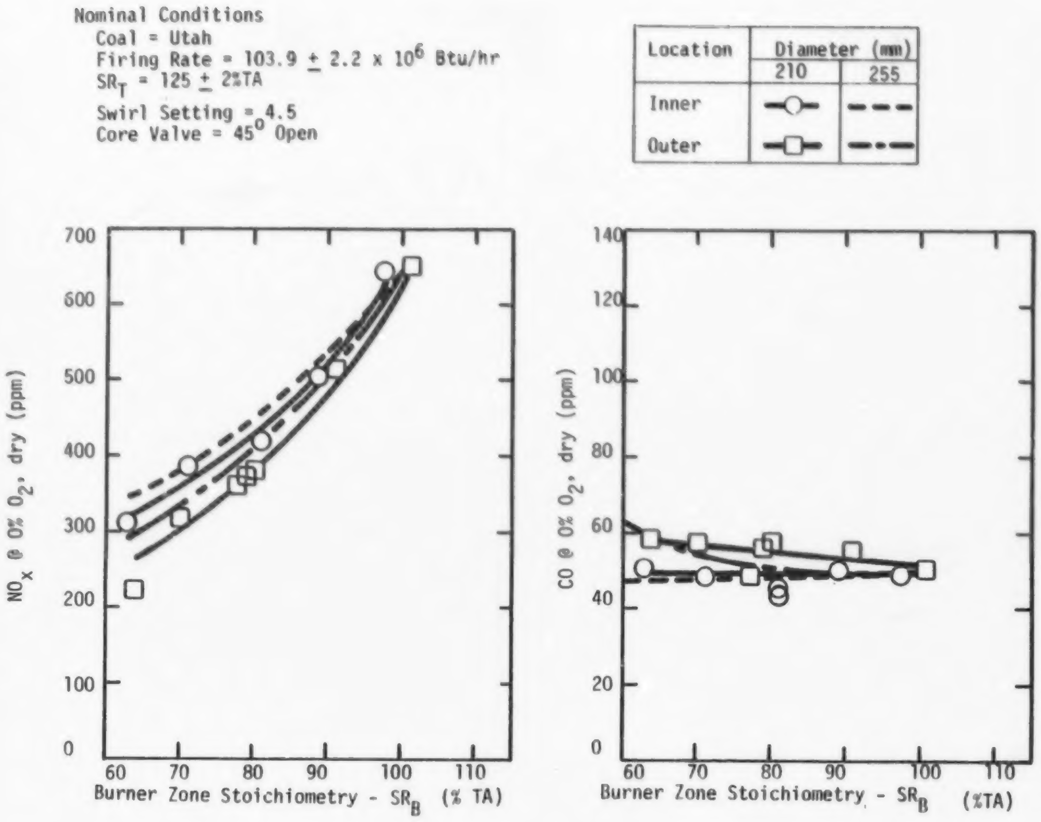


Figure 4-11. Effect of tertiary air port size on SM-II performance.

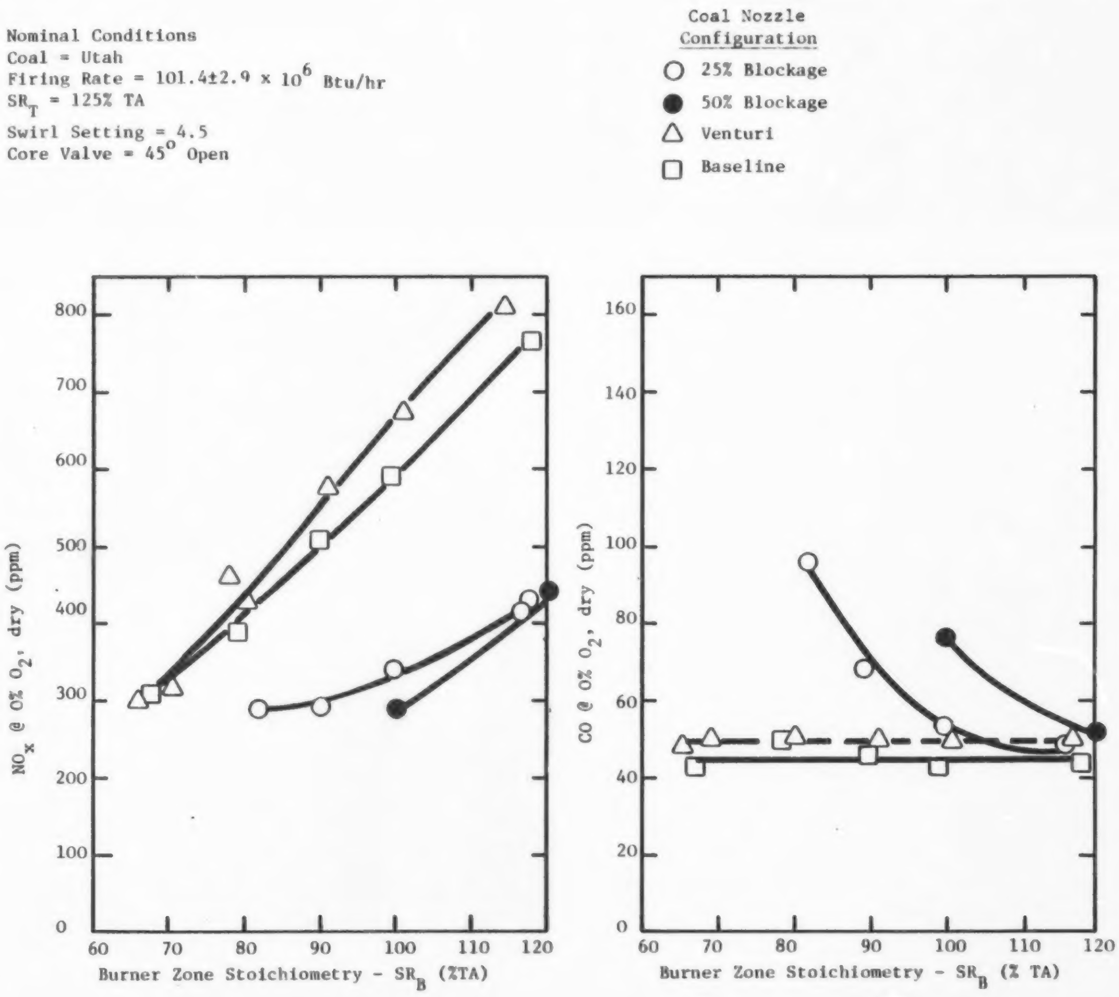


Figure 4-12. Effect of coal nozzle configuration on SM-II performance.

The coal splitter produced a narrow flame about 14 ft long with corresponding low NO_x, 425 ppm at unstaged conditions, with both 25 and 50 percent blockage. Attempts to stage this burner configuration by diverting air to the tertiary ports resulted in a dramatic increase in CO levels. The flame lengthened to over 22 ft, resulting in impingement on the rear wall of the LWS. Impingement of flames on relatively cool furnace walls causes temperatures to decrease locally, resulting in a quenching effect that decreases combustion efficiency. Flame standoff also increased at staged conditions. The long staged flame and observed standoff probably resulted from the high primary velocity, caused by reducing the coal nozzle area, causing air and fuel penetration through the recirculation zone at the base of the flame. Decreasing the burner zone stoichiometry by diverting air to the tertiary ports weakens the recirculation zone further as well as reduces the swirl momentum which promotes mixing of fuel and air. This would also tend to reduce combustion efficiency, as evidenced by high CO levels.

The coal splitter also caused operational problems, due in part to the high primary velocities resulting from blocking the coal annulus. At 25 and 50 percent blockage, the pressure drop across the coal nozzle increased from 2 in. H_2O with the basic annulus to 5.5 and 9.5 in. H_2O, respectively. The increased pressure drop effectively reduced the primary air flow by 6 percent at 25 percent blockage and 21 percent at 50 percent blockage. These restricted air flows reduced the air-to-coal ratio to the pulverizer below its design requirements, resulting in insufficient air for transport and proper classification by the pulverizer's aerodynamic classifier. The tests with this coal splitter were, thus, relatively brief since the pulverizer could not be operated in this mode for an extended period.

The venturi-shaped insert had little effect on burner performance, actually increasing NO_x emissions by about 70 ppm over the baseline annular coal nozzle. The flame length did not change significantly throughout the range tested and, at about 21 ft, was not significantly different than with the baseline coal annulus. The flame standoff increased about 12 inches, probably a result of the acceleration of the primary air/coal mixture through the throat of the venturi. The observed increase in standoff may have allowed some premixing to occur, resulting in the observed increase in NO_x emissions. The venturi insert was set back 120 mm from the coal nozzle. This setback may have allowed partial recovery of velocities through the venturi to occur and thereby reduced the effect of the venturi on the coal/air distribution at the exit of the coal nozzle.

4.3 Optimum SM-II Burner Configuration

Key test conditions from the SM-II optimization tests are summarized in Table 4-1. Included in the table are descriptions of each test condition, NO_x and CO emissions, and analyses of representative fly ash conditions. The lowest NO_x emissions with the Utah coal for nominal full load, design point operation were achieved for Test Number 7.04. This condition was achieved with the following SM-II burner hardware:

- Secondary insert
- Baseline annular coal nozzle
- Outer tertiary port locations
- Small-diameter, high-velocity tertiary ports (210 mm)

Both fly ash carbon and loss-on-ignition analyses indicated good combustion efficiency, 7.0 percent and 9.42 percent. Carbon burnout, or C_b, is based on the fly ash carbon and is defined as:

$$C_b = \left\{ 1 - \frac{\left(\frac{C_p}{A_p}\right)}{\left(\frac{C_c}{A_c}\right)} \right\} \times 100\%$$

where: C_p = percent carbon in particulate matter

A_p = percent ash in particulate matter

C_c = percent carbon in coal

A_c = percent ash in coal

TABLE 4-1 SUMMARY OF KEY SM-II TEST CONDITIONS

Test No.	Coal	Firing Rate (10^6 Btu/hr)	SR_P	SR_B	SR_T	Coal Nozzle Configuration	Tertiary Air Port Location	Tertiary Air Port Diameter (mm)	Emissions ppm @ 0% O_2		LOI (wt %)	Fly Ash Carbon (Wt %)	Carbon Burnout C_B (%)
									NO_x	CO			
1.29	Utah	97.7	0.20	0.80	1.25	BL	Inner	255	434	47	11.06	7.79	98.72
2.04	Utah	103.1	0.19	0.81	1.24	BL	Outer	255	419	50	8.76	6.31	99.99
4.07	Indiana	101.3	0.19	0.82	1.25	BL	Inner	255	481	50	12.92	9.07	98.05
5.04	Saar	107.1	0.19	0.82	1.25	BL	Inner	255	428	69	15.96	13.70	98.38
6.04	Utah	103.8	0.20	0.81	1.25	BL	Inner	210	419	45	9.61	7.26	98.82
7.04*	Utah	102.3	0.20	0.79	1.24	BL	Outer	210	368	51	9.42	7.00	98.87
13.13*	Indiana	101.8	0.19	0.80	1.25	BL	Outer	210	503	50	9.35	6.74	98.98
8.01	Utah	104.1	0.18	1.16	1.22	25% Block	N/A	N/A	411	49	13.29	10.08	98.31
8.06	Utah	95.2	0.16	1.20	1.28	50% Block	N/A	N/A	438	52	9.76	6.88	98.89
9.04	Utah	100.3	0.19	0.80	1.24	Venturi	Outer	210	425	50	11.19	8.06	98.63
15.01*	Saar	100.8	0.21	0.80	1.24	BL	Outer	210	373	62	9.34	7.30	99.21
11.05	Utah	51.4	0.40	1.10	1.24	BL	N/A	N/A	450	56	-	8.77	98.55

*Optimum SM-II Burner Configuration

At optimum condition with Utah coal, carbon burnout was 98.87. Similar results were obtained with Indiana and Saar coals for the same configuration, test numbers 13.13 and 15.01, respectively. However, tests with Saar coal generally produced the highest CO emissions and carbon in the fly ash indicating loss in efficiency. This tendency was most significant with the Weiher SM burner. Since observed operating conditions and flame characteristics did not appear to account for any difference among the test fuels, this combustion efficiency problem was probably related to Saar coal characteristics discussed earlier.

Characteristic performance curves were verified for each coal at the optimum burner configuration. The effect of staging is summarized in Figure 4-13. The optimized burner was more sensitive to burner zone stoichiometry than the baseline burner, although the optimized burner produced lower NO_x emissions at SR_B less than 80 percent. CO emissions were similar for both burners, with the Saar coal producing the highest levels. Fly ash carbon for the Weiher SM burner, 25 to 33 percent, was much greater than for the optimized burner, about 7.3 percent. The excess air operating range was evaluated only with the Utah coal for the SM-II burner. The effect of excess air for the optimized SM-II burner is compared with the Weiher SM test results in Figure 4-14. The effect of excess air on NO_x emissions was much less for the SM-II burner with the Utah coal. The apparent threshold level of excess air where combustion efficiency decreases, was at an SR_T of 120 percent for the Weiher burner. This is much higher than for the optimized burner, which could operate as low as 10 percent excess air with only a slight increase in CO emissions.

The effect of firing rate is shown in Figure 4-15 for the SM-II burner. For unstaged operation, NO_x emissions were over 100 ppm higher for the SM-II burner than the Weiher SM burner (from Figure 4-4). As load was decreased below 90 x 10^6 Btu/hr, the difference between the baseline and optimized burners became insignificant. Combustion efficiency, as indicated by CO emissions decreased substantially for the baseline burner at reduced loads, while CO emissions remained relatively constant for the optimized burner. A complete turndown test at staged conditions was not conducted for the

Nominal Conditions

Firing Rate =101.3±1.9 x 10^6 Btu/hr
SR_T = 125±1.0% TA
Swirl Setting = 4.5
Core Valve = 45° Open

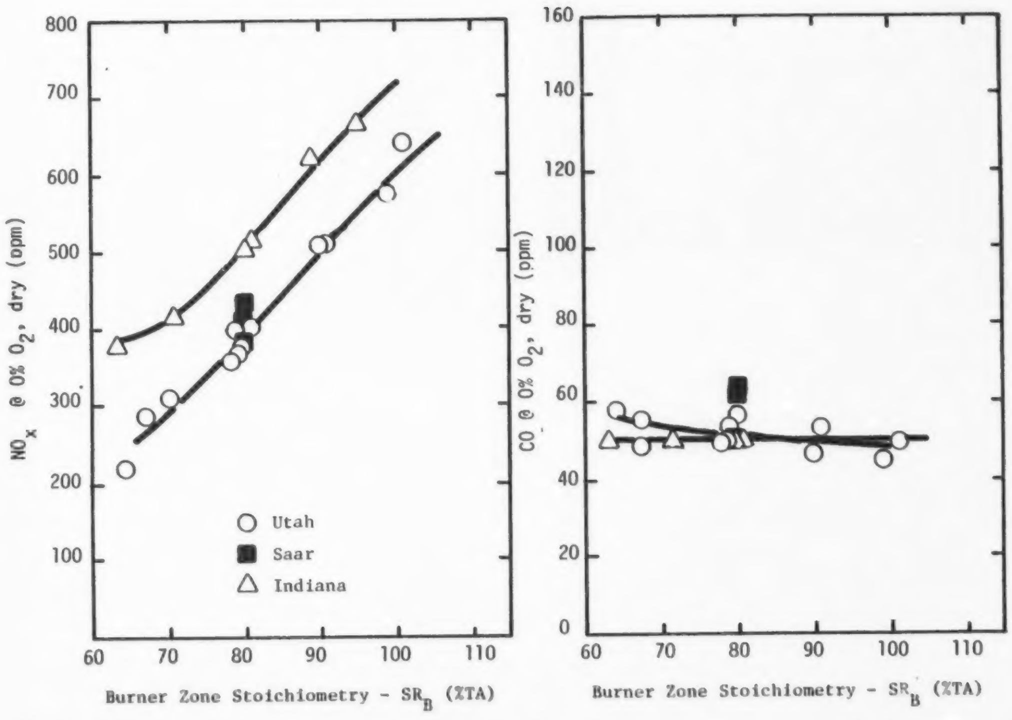


Figure 4-13. Effect of staging on SM-II optimum configuration performance.

Nominal Conditions

Coal = Utah
Firing Rate = 103.8±2.9 x 10^6 Btu/hr
SR_B = 80.1±2.0±TA
Swirl Setting = 45
Core Valve = 45° Open

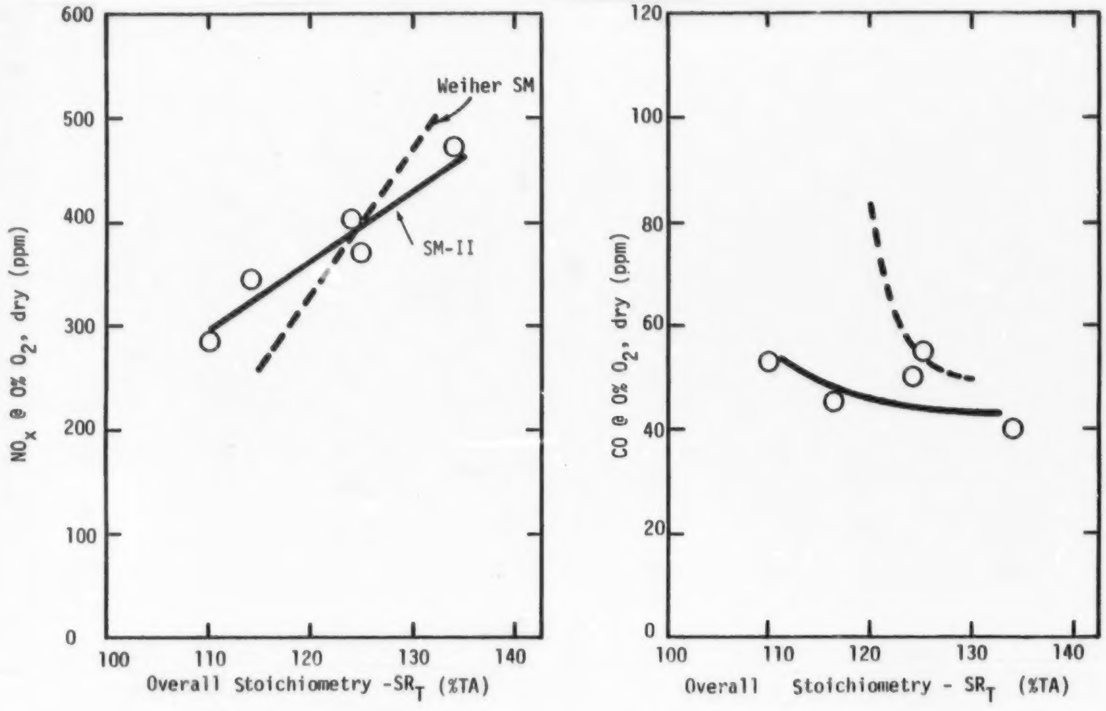


Figure 4-14. Effect of excess air on the optimum SM-II burner configuration.

Nominal Conditions

Coal = Utah
SR_T = 126% TA
Swirl Setting = 4.5
Core Valve = 45° Open

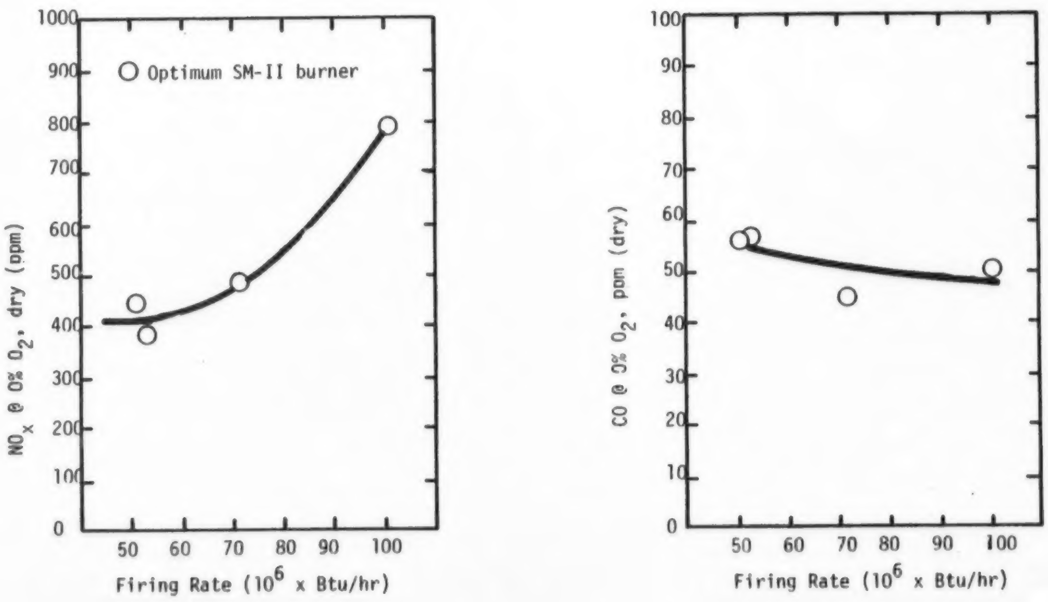


Figure 4-15. Effect of turndown on unstaged emissions from optimum SM-II burner configuration.

optimized burner because of increasing flame standoff. The Weiher burner, however, was tested over the entire load range. Flame stability was marginally acceptable although flame standoff did increase significantly for the baseline SM burner. Firing rate had little effect on NO_x, reducing emissions about 18 percent for a 50 percent reduction in load. CO levels, an indication of combustion efficiency, increased to about 90 ppm at staged conditions, similar to the results obtained during unstaged operation.

Although complete staged characterization at reduced load was not obtained for the SM-II burner, limited tests were conducted at about 73 x 10^6 Btu/hr. These data are compared to full load data in Figure 4-16. The effect of staging was much less at lower load. At the design point SR_B, NO_x was reduced from about 380 ppm to 325 ppm. CO emissions increased slightly as staging was increased. The flame at this reduced load and staged condition was about 14-16 ft long and had no appreciable standoff. Attempts at staging the SM-II burner at 50 percent load resulted in the flame lifting off the burner and decreased flame stability.

Overall performance of the basic SM burner was improved with the SM-II modifications. NO_x emissions were lower at design point conditions and combustion efficiency was better. The range of operation, including excess air and turndown, was maintained if not improved. Range of operation could probably be further enhanced by redesign of the secondary swirl device to increase the degree of swirl. This would probably allow staged operation over the entire load range and maintain a stable attached flame.

Nominal Conditions

Coal = Utah
Firing Rate = 72.7±1.6 x 10^6 Btu/hr
SR_T = 123.8±1.5% TA
Swirl Setting = 4.5
Core Valve = 45° Open

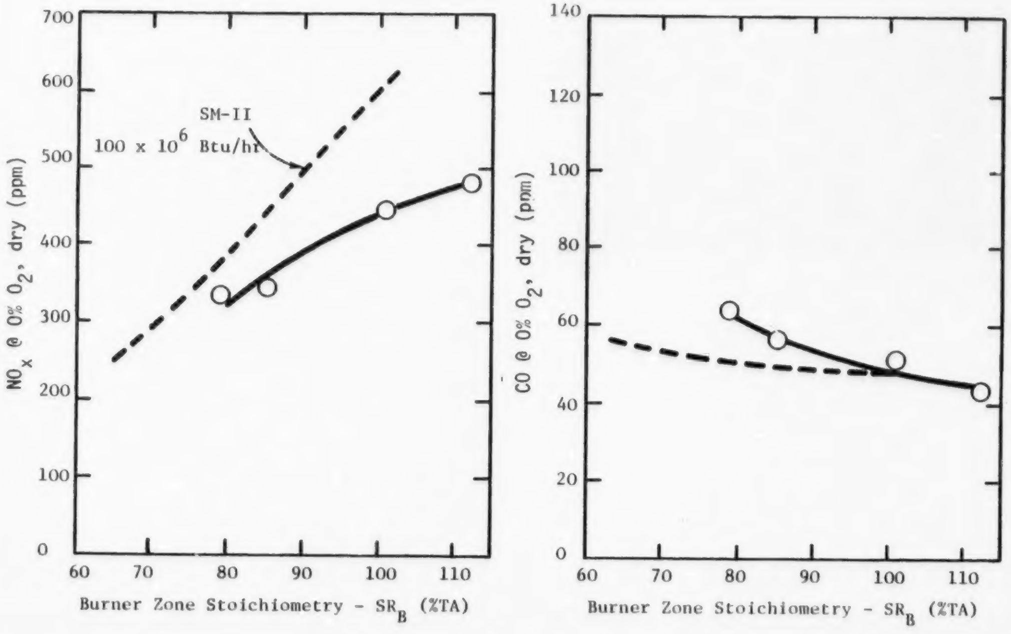


Figure 4-16. Effect of staging on reduced load performance of the optimum SM-II burner configuration.

5.0 SO_2 REDUCTION WITH SORBENT INJECTION

Combined NO_x and SO_2 control was evaluated with the Steinmüller SM burners in the LWS with the injection of calcium-based sorbents through the burner passages. The objectives of the sorbent injection tests were:

1. To establish the SO_2 reduction potential of the SM burners.
2. To determine any tradeoffs that might be necessary to maximize SO_2 reduction.

These objectives were accomplished by evaluating the following operating variables:

1. Fuel composition
2. Sorbent composition
3. Sorbent feed rate
4. Injection location
5. Tertiary air velocity

5.1 SO_2 Reduction with the Weiher SM Burner

The SO_2 reduction trials with the Weiher SM burner utilized three sorbents, three injection locations, and three coals. The sorbents, described in section 3.2, included two processed German sorbents, RWK $Ca(OH)_2$ and RWK $CaCO_3$, and a U.S. limestone, Vicron 45-3. These pre-pulverized sorbents were injected with the coal at the pulverizer (referred to as mill injection), through pipes located on the axis of the inner tertiary ports (IT), and through pipes located on the axis of the outer tertiary ports (OT). For the Weiher SM burner configuration, tertiary air flowed through the inner set of ports only. The injection of sorbent through axially located pipes in the outer tertiary ports with tertiary air flow through the inner ports represents a potential similar configuration for sorbent injection at the Weiher boiler. The majority of the SO_2 tests were conducted with the Saar coal to establish a basis for comparison with sorbent injection tests planned at Weiher III. Additional sorbent tests utilized Utah and Indiana coals for comparison with tests at EER with other commercial burners evaluated in the LWS as well as smaller scale LIMB studies.

5.1.1 Sorbent Injection with U.S. Coals

Sorbent injection tests of the Weiher SM burner fired with Utah coal were conducted at nominal full load conditions, both with and without staging. The results from the staged tests, with Vicron injected through the three locations, are summarized in Figure 5-1. Injection of the Vicron through the inner tertiary air ports achieved the greatest SO_2 reduction, about 37 percent at a Ca/S molar ratio of 2. Injection of the sorbent through the outer tertiary pipes and with the coal produced about 30 percent SO_2 capture at a Ca/S molar ratio of 2. For Ca/S molar ratios less than 2, SO_2 reduction was comparable for injection with the coal or through the outer ports. However, for Ca/S molar ratios greater than 2, sorbent capture was greater with injection through the mill than through the outer tertiary ports. In earlier studies at the IFRF with the SM burner, however, injection of sorbent through nozzles located radially outside the tertiary air ports yielded the highest SO_2 capture[2]. The firing rate during the injection of Vicron through the outer ports was about 10 percent higher than during the other tests shown in the figure. Since the thermal environment that the sorbent is exposed to is an important criteria in the efficiency of sulfur capture, this higher firing rate may have exposed the sorbent particles to higher local temperatures, thus reducing sorbent reactivity. Also included in Figure 5-1 are data from a brief series of tests with RWK $Ca(OH)_2$ injected through nozzles located on the axes of the inner tertiary ports. This sorbent yielded about 49 percent reduction in SO_2 at a Ca/S molar ratio of 2, significantly higher than the Vicron limestone. This is typical of trends measured during previous work.

A similar series of tests was conducted with the higher sulfur Indiana coal at nominal full load staged conditions. The results are summarized in Figure 5-2. The hydrated lime material achieved the highest capture for Ca/S molar ratios greater than 2, however, for lower Ca/S molar ratios, sulfur

Nominal Conditions

Coal = Utah
Swirl Setting = 4.0
Tertiary Air Location = Inner Ports
Tertiary Port Diameter = 255 mm

	Sorbent	Injection Location	Firing Rate (10^6 Btu/hr)	SR_B (%TA)	SR_T (%TA)
○	Vicron	IT	101.5±2.7	84±2.0	128±2.0
■	Vicron	OT	110.0±2.7	80±1.9	124±3.0
△	Vicron	MILL	102.0±1.8	85±1.0	130±2.0
◆	RWK $Ca(OH)_2$	IT	103.9±0.7	85±1.4	132±1.4

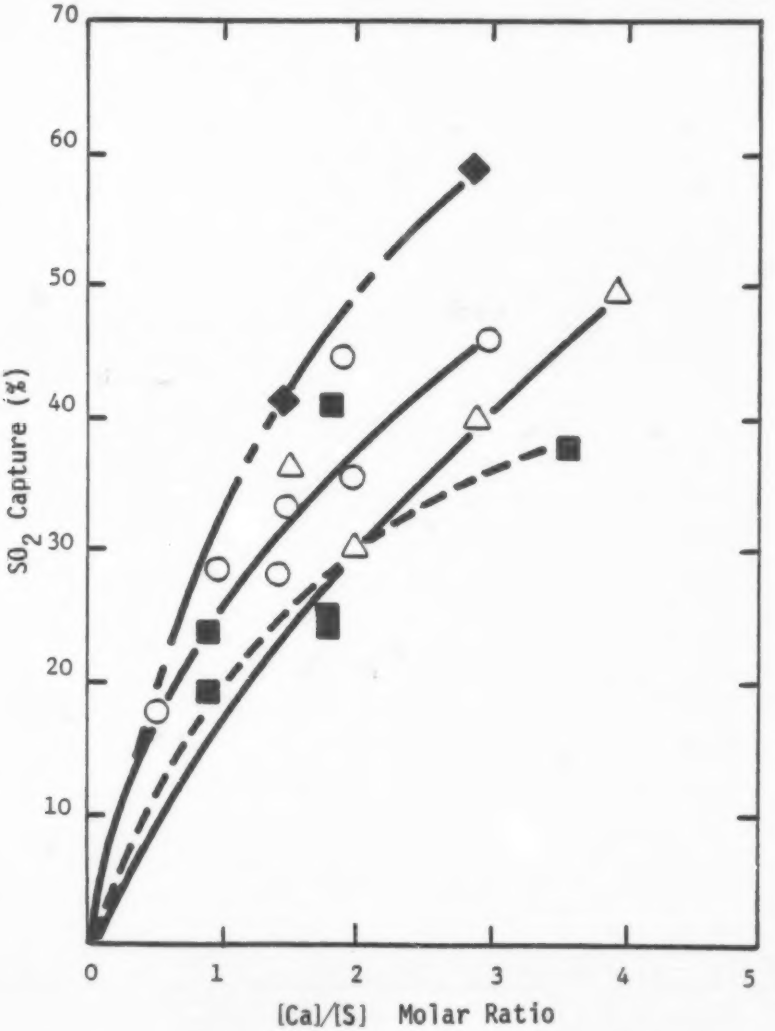


Figure 5-1. Summary of sorbent injection tests of Weiher SM burner with Utah coal at staged conditions.

Nominal Conditions

Coal = Indiana
Swirl Setting = 5.0
Tertiary Air Location = Inner Ports
Tertiary Port Diameter = 255 mm

	Sorbent	Injection Location	Firing Rate (10^6 Btu/hr)	SR_B (%TA)	SR_T (%TA)
○	Vicron	IT	103.7±1.8	80±1.0	125±1.0
■	RWK $Ca(OH)_2$	IT	104.3±1.1	78±1.0	122±1.5
△	Vicron	MILL	102.8±1.4	77±2.0	123±2.0

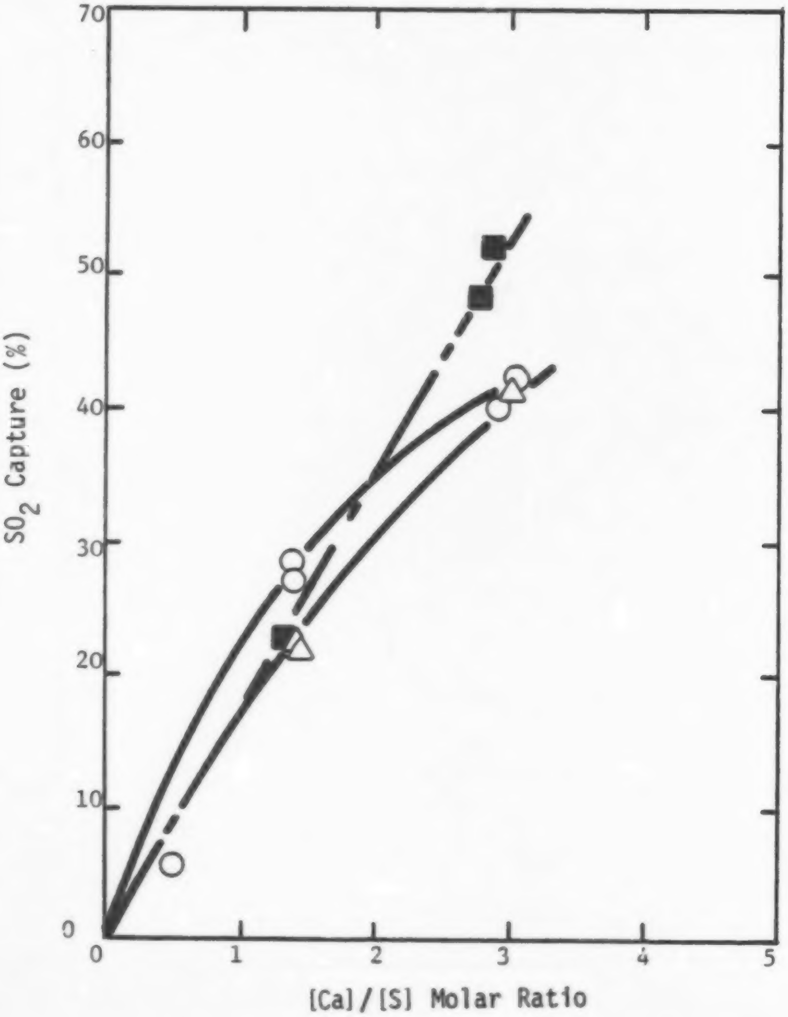


Figure 5-2. Summary of sorbent injection tests of the Weiher SM burner with Indiana coal at staged conditions.

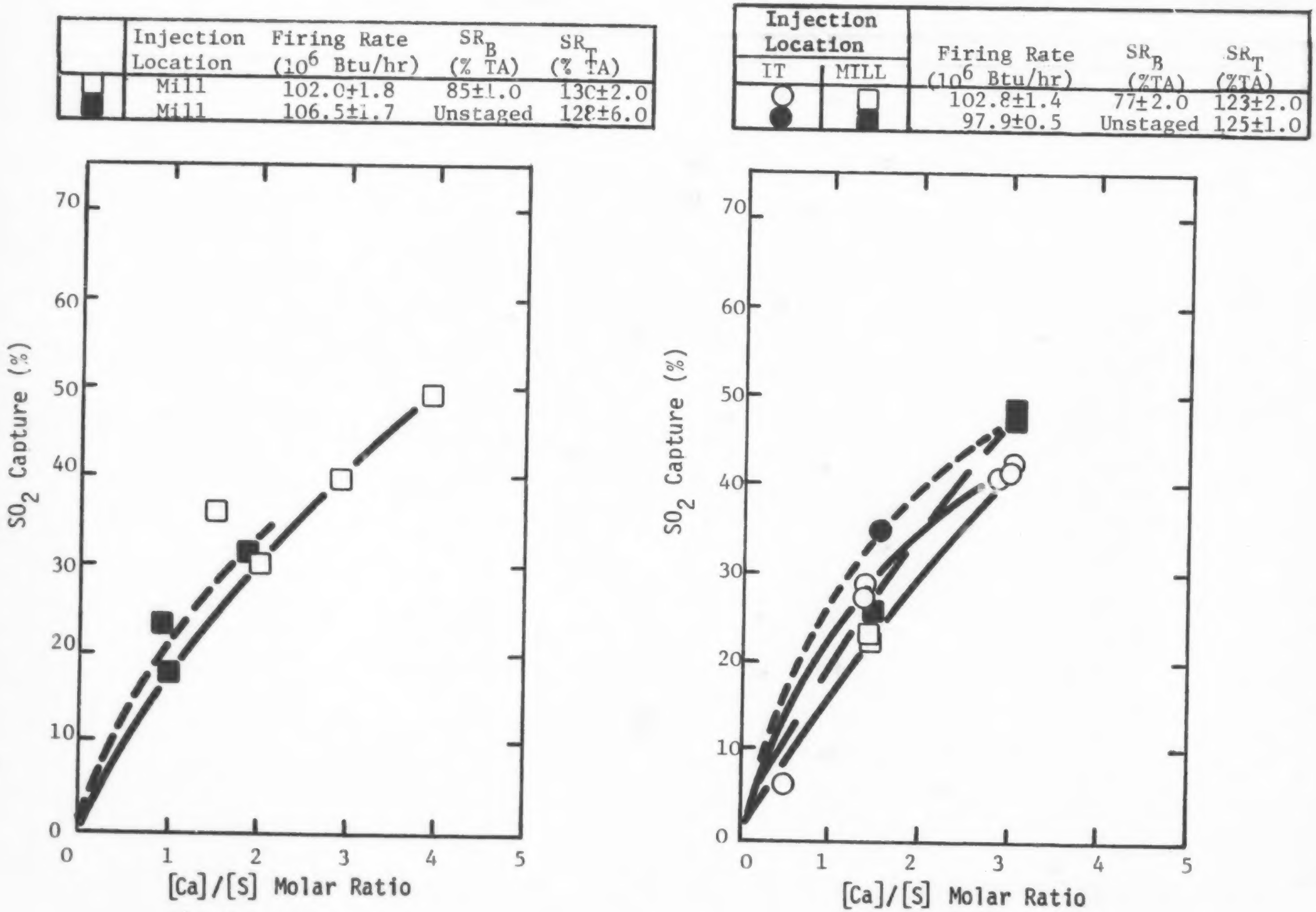
capture was comparable for all three sorbent/injection location combinations tried with the Indiana coal. At a Ca/S molar ratio of 2, the RWK $Ca(OH)_2$ and the Vicron limestone yielded about 35 percent SO_2 reduction. The capture achieved with the Vicron was somewhat higher when injected through the inner tertiary ports (35 percent) than when added to the pulverized coal (30 percent).

The effect of staging on sulfur capture with the two U.S. coals was relatively small. The data for the two coals are shown in Figure 5-3. Unstaged conditions produced slightly higher SO_2 capture than nominal staged conditions for both coals. For the Utah coal, shown in Figure 5-3 (a), injection of Vicron limestone with the coal at unstaged conditions achieved about 33 percent capture at a Ca/S molar ratio of 2 and about 30 percent at staged conditions. Similar differences were measured for the Indiana coal for Vicron injection in both the mill and through the inner tertiary ports. The trends for staged and unstaged conditions in Figure 5-3(b) are nearly identical, with SO_2 reduction for the two different injection locations matching at a Ca/S molar ratio of 3. Inner tertiary injection at unstaged conditions yielded about 39 percent capture at a Ca/S molar ratio of 2, while at staged conditions SO_2 capture was at 35 percent. Sorbent addition with the coal achieved 33 percent for staged conditions.

The absolute differences in staged and unstaged capture are relatively small, less than 5 percent, however, the trends are consistent for both coals. Earlier trials with the SM burner at the IFRF demonstrated higher SO_2 capture at staged conditions. It would be expected, particularly for sorbents injected with the coal, that the more intense and hotter flames produced at unstaged conditions might result in high local temperatures that would tend to decrease the reactivity of sorbent particles.

5.1.2 Sorbent Injection with the Saar Coal

The evaluation of SO_2 reduction potential with the Weiher SM burner was most extensively studied with the Saar coal, emphasizing the two German sorbents. These tests evaluated the possible sorbent injection scenarios



a) Utah coal

b) Indiana coal

Figure 5-3. Effect of staging the Weiher SM burner on SO_2 capture.

planned for Weiher III, and thus establish a link between LWS tests and an operating boiler. The tests with the Saar coal included all three sorbents and injection configurations at full load. A brief series of tests at half load was also performed with the three sorbents injected through the outer tertiary ports.

Results from sorbent injection tests with Saar coal at nominal full load staged operation of the Weiher SM burner are summarized in Figure 5-4. The two limestone sorbents, the Vicron and the RWK $CaCO_3$, achieved similar SO_2 reduction when injected with the coal, 35 percent and 32 percent at a Ca/S molar ratio of 2, respectively. Sulfur dioxide capture with RWK hydrated lime injected with the coal yielded lower capture, particularly for Ca/S molar ratios greater than 2. Performance of the hydrated lime was much better when injected through either the inner and outer tertiary ports, as shown in Figure 5-4(b) and (c), achieving 49 percent and 54 percent capture at a Ca/S molar ratio of 2, respectively. Capture with the Vicron and RWK limestones was again similar for injection through the inner tertiary air ports, about 32 percent at a Ca/S molar ratio of 2. However, injection through the outer tertiary ports resulted in substantially higher capture with the Vicron limestone (40 percent at a Ca/S molar ratio of 2) than with the RWK limestone (29 percent).

The reason for the difference between the two limestones when injected through the outer ports is not clear, however, there were some differences in the test conditions. First, the average firing rate was 107.3×10^6 Btu/hr for the RWK $CaCO_3$ tests and 103.8×10^6 Btu/hr during the Vicron tests. Also, both the burner zone stoichiometry and the excess air levels were lower by 4 percent T.A. during the RWK $CaCO_3$ tests. The higher load and lower excess air level may have produced slightly higher bulk furnace temperatures which could have affected sorbent reactivity.

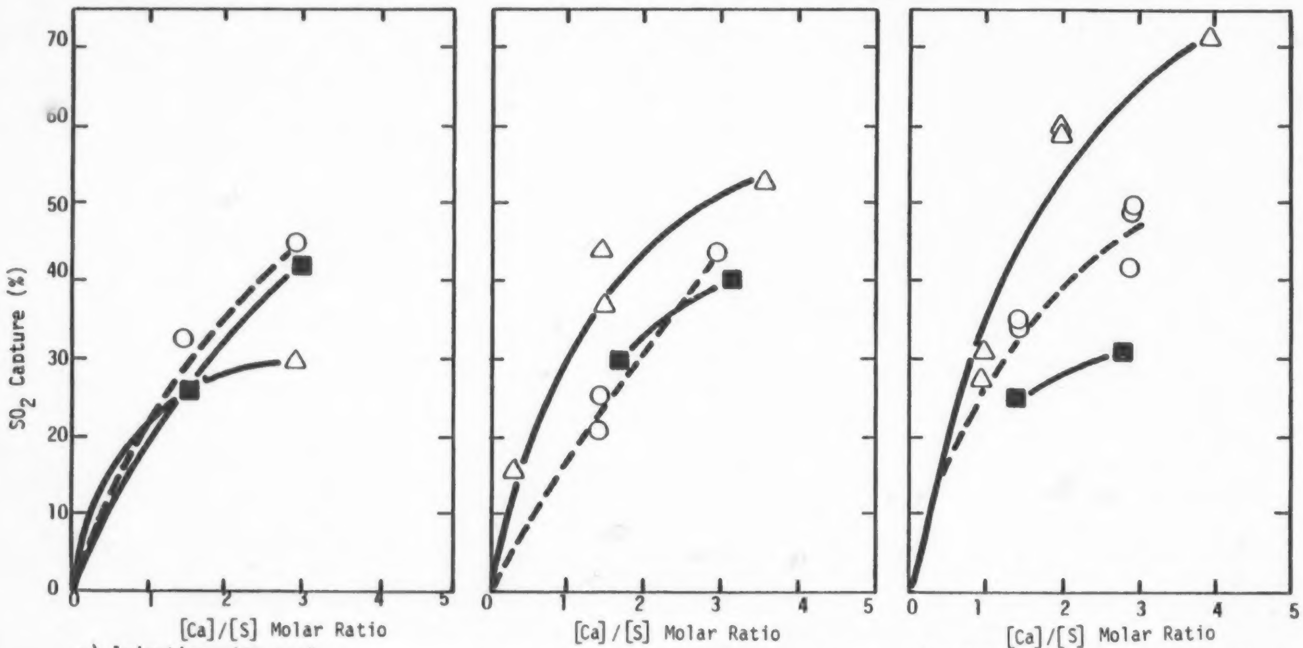
The effect of staging on sulfur capture is compared for the two limestone materials injected into the coal stream in Figure 5-5. Capture with Vicron was slightly lower, 33 percent for a Ca/S molar ratio of 2, at unstaged conditions than at staged conditions, 36 percent. There was a

Nominal Conditions
Coal = Saar
Swirl Setting = 4.0
Tertiary Air Location = Inner
Tertiary Port Diameter = 255mm

	Sorbent	Firing Rate (10^6 Btu/hr)	SR_B (%TA)	SR_T (%TA)
○	Vicron	101.6±1.3	89±1.0	125±2.0
■	RWK $CaCO_3$	98.6±0	91±0	129±1.0
△	RWK $Ca(OH)_2$	103.2±0.3	86±2.0	122±2.0

	Sorbent	Firing Rate (10^6 Btu/hr)	SR_B (%TA)	SR_T (%TA)
○	Vicron	101.5±0.4	87±1.0	121±1.0
■	RWK $CaCO_3$	100.3±3.5	89±1.0	123±3.0
△	RWK $Ca(OH)_2$	102.5±0.8	87±1.0	120±1.0

	Sorbent	Firing Rate (10^6 Btu/hr)	SR_B (%TA)	SR_T (%TA)
○	Vicron	103.8±0.9	89±1.0	126±1.0
■	RWK $CaCO_3$	107.3±3.0	85±1.0	121±1.0
△	RWK $Ca(OH)_2$	103.8±2.25	90±2.0	126±3.0



a) Injection with coal

b) Injection through inner tertiary ports with staging air

c) Injection through outer tertiary ports

Figure 5-4. Summary of sorbent injection tests of Weiher SM burner with Saar coal at staged conditions.

Nominal Conditions
Coal = Saar
Swirl Setting = 4.0
Tertiary Air Location = Inner Ports
Tertiary Port Diameter = 255mm

	Sorbent	Sorbent Injection Location	Firing Rate (10^5 Btu/hr)	SR_B (%TA)	SR_T (%TA)
○	Vicron	Mill	101.6±1.3	89±1.0	125±2.0
●	Vicron	Mill	102.5±3.2	Unstaged	126±3.0
□	RWK $CaCO_3$	Mill	98.6±0	91±0	129±1.0
■	RWK $CaCO_3$	Mill	104.7±0	Unstaged	124±0

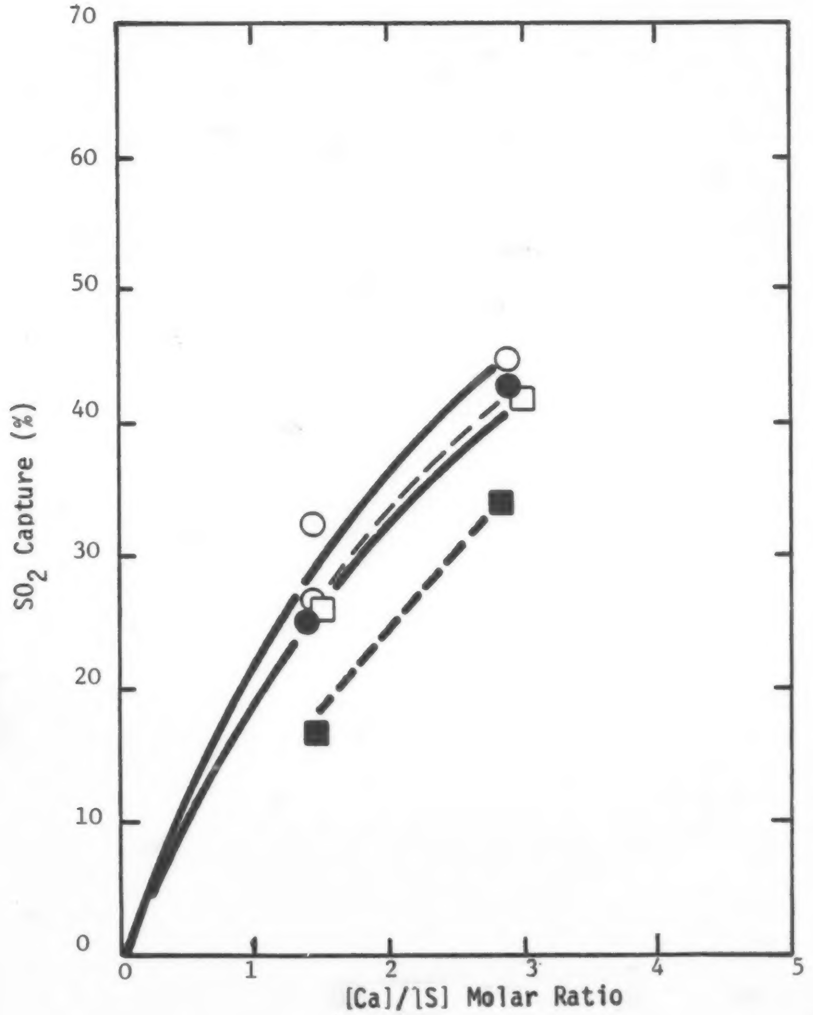


Figure 5-5. Effect of staging the Weiher SM burner on sulfur capture.

greater effect of staging on sulfur capture by the RWK limestone. Sulfur capture at a Ca/S molar ratio of 2 was only 23 percent for unstaged conditions, but 33 percent when the burner was staged. The firing rate was also about 6 percent higher during the unstaged tests. Both factors probably contribute to higher local flame temperatures for the unstaged condition which can affect sorbent reactivity. The observed trends are different than the effect of staging on sulfur capture with the two U.S. coals. However, the small effect of staging on capture with Vicron may be considered negligible.

Thermal environment is an important factor in the capture of sulfur species by sorbents. Residence time in the temperature regime necessary for sulfation predicates the degree of SO_2 reduction by the sorbent. Sorbent capture at half load, 50×10^6 Btu/hr, is compared with data from full load tests in Figure 5-6. The three sorbents were injected through the outer tertiary ports, with the burner operated unstaged (no air through either the inner or outer tertiary ports). The RWK $Ca(OH)_2$ achieved the highest capture, 55 percent at a Ca/S molar ratio of 2, with the two limestones obtaining about 42 percent capture. In general capture at half load, unstaged operation was similar to capture at full load and staged conditions. Again, the RWK limestone was most sensitive to load or thermal environment, with full load staged capture being only 28 percent. Vicron limestone was the only sorbent with comparable unstaged conditions at full and half load. Capture at low load was significantly better, 42 percent at a Ca/S molar ratio of 2, compared with full load unstaged conditions, 27 percent. Because of the design and mode of operation of the LWS, a reduction in load increases the mean residence time but also reduces the mean furnace temperature. The result, in general, is that the time available in the sulfation temperature window (2200-1500°F) is relatively insensitive to load and little effect of firing rate on sulfur capture would be expected.

5.2 SO_2 Reduction with the Optimized SM-II Burner

The potential for SO_2 reduction for the SM-II burner was evaluated for two configurations, one utilizing the inner set of tertiary ports, 255 mm

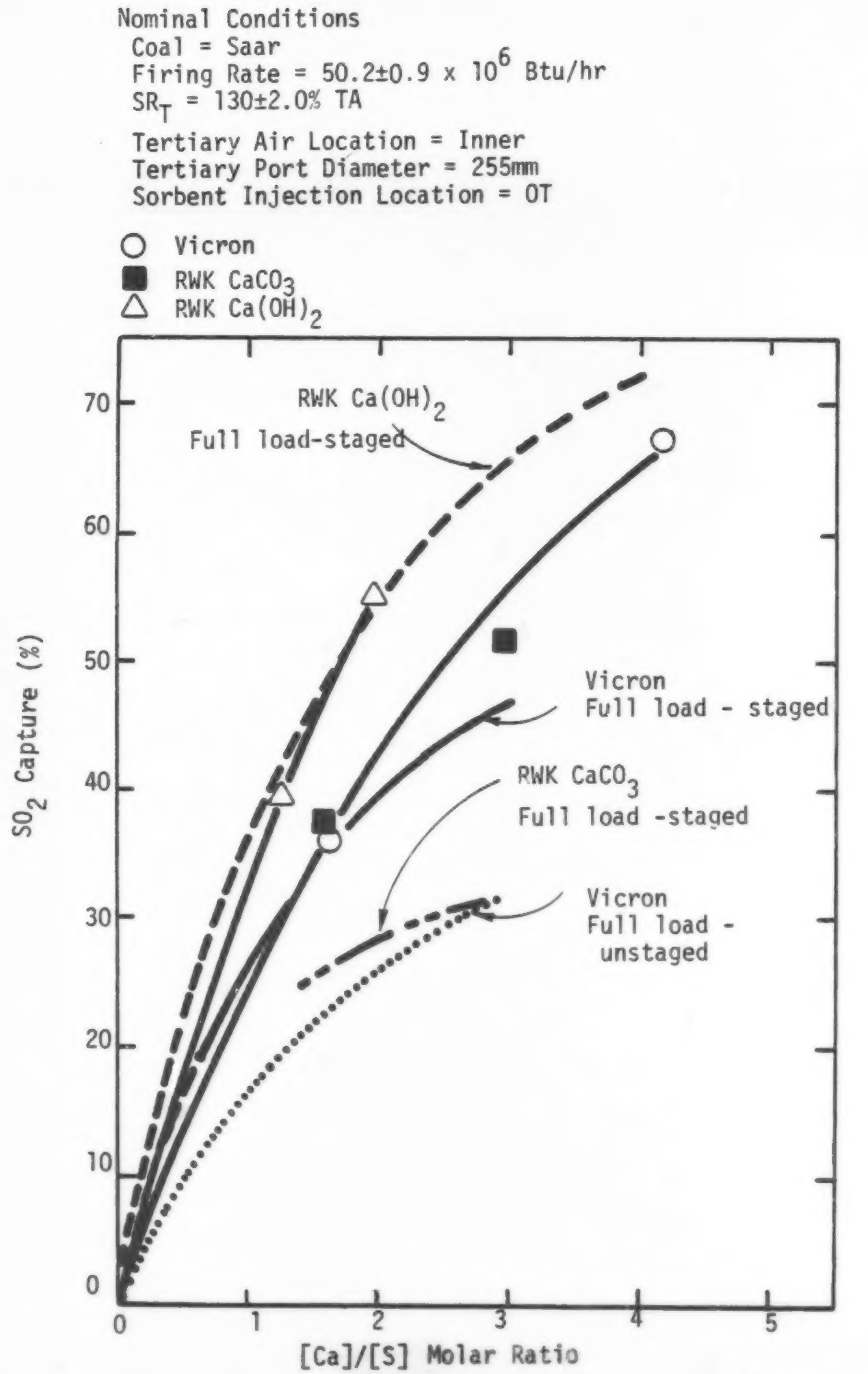


Figure 5-6. Effect of firing rate on SO_2 capture with the Weiher SM burner.

diameter of the Weiher SM design, and the other using the outer set of ports with 210 mm inserts. The latter represents the optimum arrangement for low NO_x emissions while the former served as a baseline comparison of the Weiher burner. Two sorbents were used, the Vicron limestone and the RWK $Ca(OH)_2$. Three injection locations were also used: with the coal, through the inner tertiary ports, and through the outer ports. Sorbent was injected only through the tertiary ports through which the tertiary air flowed.

5.2.1 Sorbent Injection with Utah Coal

Sorbent injection tests with the SM-II burner were principally performed on the optimum configuration, which incorporated the small diameter tertiary port inserts and the outer set of ports. The results of the sorbent injection tests with this optimized SM-II burner and Utah coal are summarized in Figure 3-7. The open symbols represent data from tests using the outer set of ports for both tertiary air and sorbent injection. The solid symbols illustrate data for inner tertiary air and sorbent injection. For this burner, injection location had negligible effect on sulfur capture. The Vicron limestone achieved almost 30 percent capture at a Ca/S molar ratio of 2 whether injected with the coal or through either set of tertiary ports. For a Ca/S molar ratio of 2 or less, there was no measurable difference in capture with the RWK hydrated lime when injected through either tertiary air location. At a Ca/S molar ratio of 2, the hydrated lime yielded about 41 percent SO_2 reduction. The inner tertiary port location appears to achieve higher captures at high Ca/S molar ratios.

Previous studies have suggested that SO_2 capture may be influenced by a relationship between sorbent injection velocity and tertiary air velocity. A series of tests was conducted with the SM-II burner and the inner tertiary air ports to evaluate this phenomenon. Tertiary air velocity was varied using the available inserts that resulted in tertiary air velocities that varied by a factor of about 1.6. Constant sorbent injection velocity of 115 ft/sec was maintained during these tests, with results summarized in Figure 5-8. For both tertiary air velocity cases, the RWK hydrated lime achieved the highest capture, 42 percent at a Ca/S molar ratio of 2. The Vicron

Nominal Conditions

Coal = Utah
Firing Rate = 100.6±1.6 x 10^6Btu/hr
SR_B = 80±1.0% TA
SR_T = 125±1.0% TA
Swirl Setting = 4.5
Core Valve = 45° Open
Tertiary Port Diameter = 210 mm
Sorbent Injection Velocity = 115 ft/sec.

Injection Location			
Mill	IT	OT	Sorbent
□	▲	△	Vicron 45-3
	●	○	RWK $Ca(OH)_2$

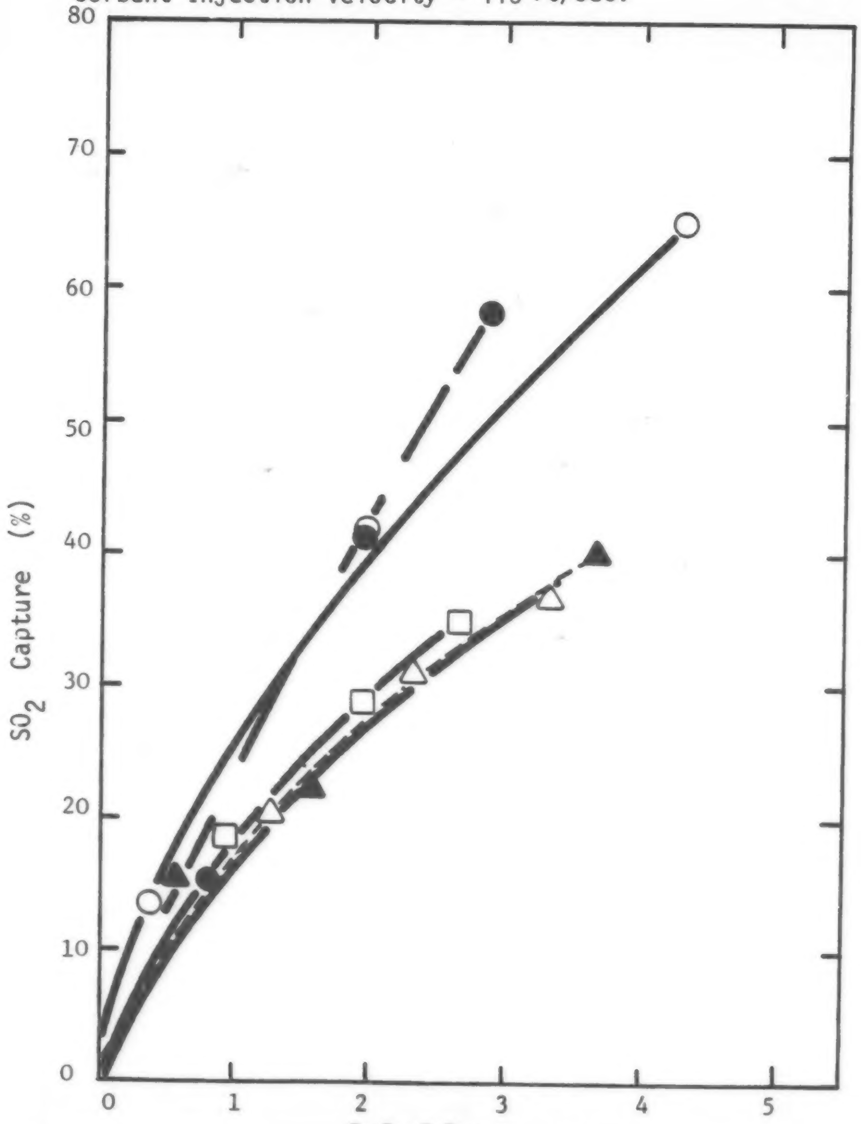


Figure 5-7. Summary of sorbent injection tests of optimized SM-II burner with Utah coal at staged conditions.

Nominal Conditions

Coal = Utah
Firing Rate = 100.6±1.6 x 10^6 Btu/hr
SR_B 80±1.2% TA
SR_T = 125±2.0% TA
Swirl Setting = 4.5
Core Valve = 45° Open
Tertiary Port Location = Inner
Sorbent Injection Velocity = 115 ft/sec.

Tertiary Port Diameter (mm)	255	210
Tertiary Air Velocity (ft/sec)	100	165
Vicron	▲	△
RWK $Ca(OH)_2$	●	○

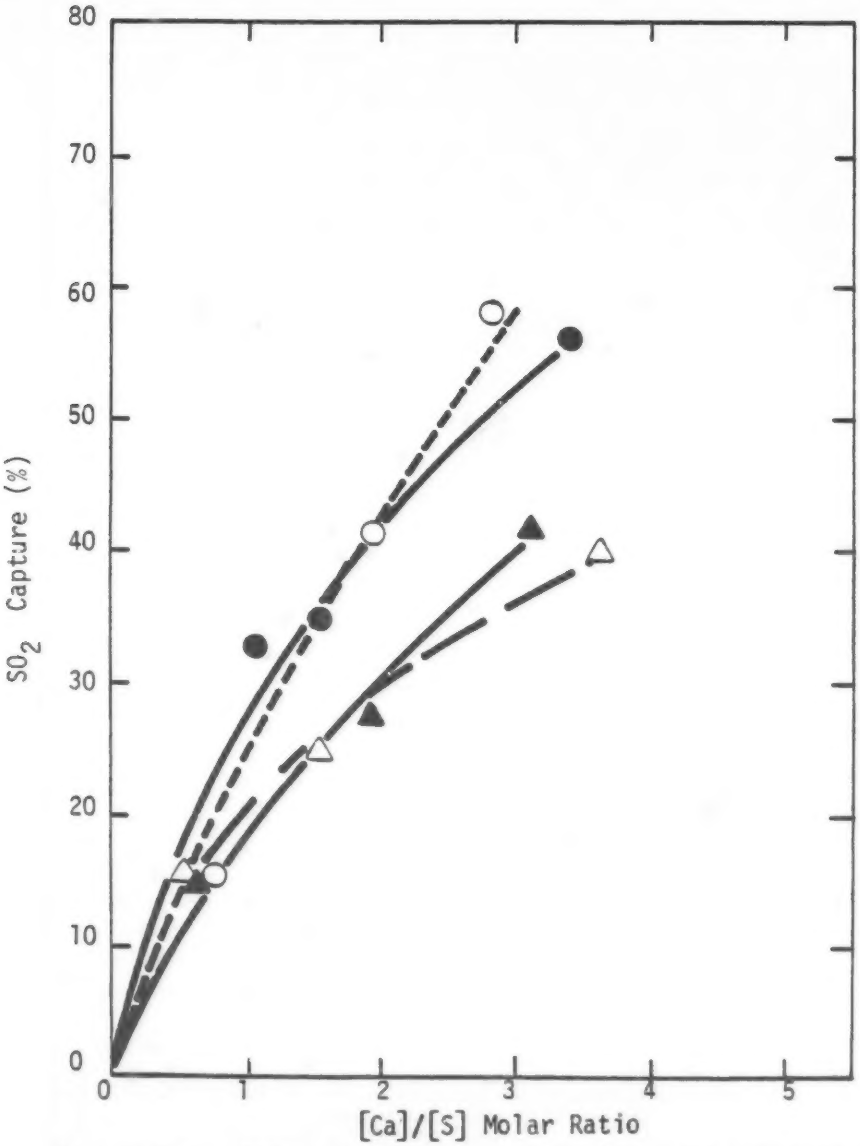


Figure 5-8. Effect of tertiary velocity on SO_2 capture with the SM-II burner.

achieved about 30 percent SO_2 reduction at a Ca/S molar ratio of 2 for both cases. For this burner configuration, tertiary air velocity did not have a significant effect on SO_2 capture.

Thermal environment was evaluated briefly using the SM-II burner with the large diameter, inner tertiary air ports. As discussed previously, thermal environment is an important factor in the capture of sulfur species by sorbents. Reduced load tests were conducted with Vicron as the sorbent at about 54 x 10^6 Btu/hr. This resulted in a decrease in the furnace outlet temperature from 1750°F at 100 x 10^6 Btu/hr to about 1550°F. These reduced load tests were conducted at unstaged conditions to maintain flame stability while injecting sorbents into the flame zone. The results of the low load tests are shown in Figure 5-9. Inasmuch as no sorbent injection was done at full load unstaged operation, data from staged conditions with Vicron added through the inner tertiary ports is included for comparison. Vicron was injected through the inner tertiary ports and with the coal, with both locations yielding similar SO_2 reduction. Capture at these reduced load unstaged conditions is also comparable to that achieved at full load staged conditions. This similarity in the sulfur capture for these two different firing rates is again related to the characteristics of the LWS. In addition to reducing the mean furnace temperature at reduced load, the mean residence time increases such that the time available in the sulfation temperature window (2200-1500°F) is generally insensitive to load in the LWS. Thus, little effect of firing rate on SO_2 capture would be expected.

5.2.2 Sorbent Injection with Alternate Fuels

Only limited sorbent testing was conducted with the two other coals, Indiana and Saar. The tests with the Indiana coal utilized the optimum SM-II burner configuration, which utilized the small diameter, outer tertiary air ports. The data from the Indiana coal tests are shown in Figure 5-10. Injection location had negligible effect on SO_2 capture with Vicron limestone, resulting in about33 percent capture at a Ca/S molar ratio of 2. The hydrated lime injected through the tertiary ports achieved 51 percent capture at a Ca/S molar ratio of 2.

Nominal Conditions
Coal = Utah
Sorbent = Vicron
Firing Rate = 53.9±0.7 x 10^6 Btu/hr
SR_T = 124% TA
Swirl Setting = 4.5
Core Valve = 45° Open
Tertiary Air Location = Inner
Tertiary Port Diameter = 255mm

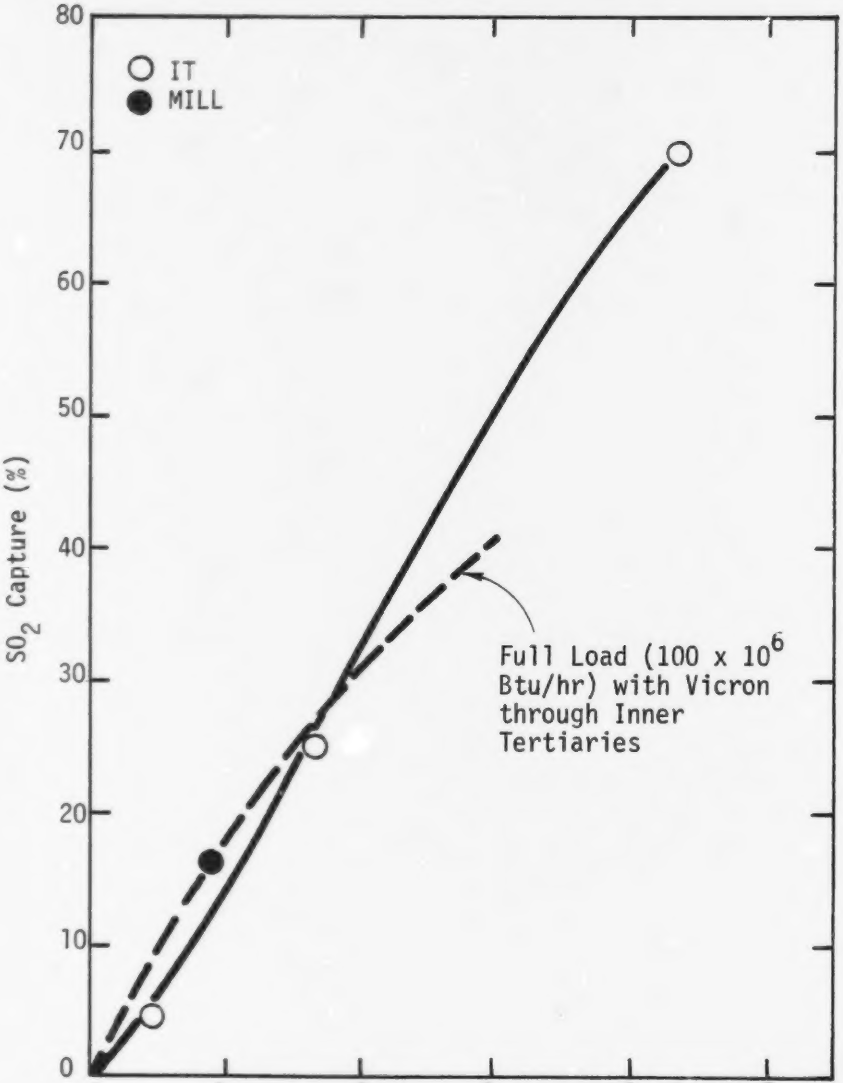


Figure 5-9. Effect of firing rate on SO_2 capture with the SM-II burner for unstaged operation.

Nominal Conditions
Coal = Indiana
Firing Rate = 101.3±3.0 x 10^6 Btu/hr
SR_B = 79.1±3.0% TA
SR_T = 124±2.0%TA
Swirl Setting = 4.5
Core Valve = 45° Open
Tertiary Port Diameter = 210mm
Tertiary Air Location = Outer

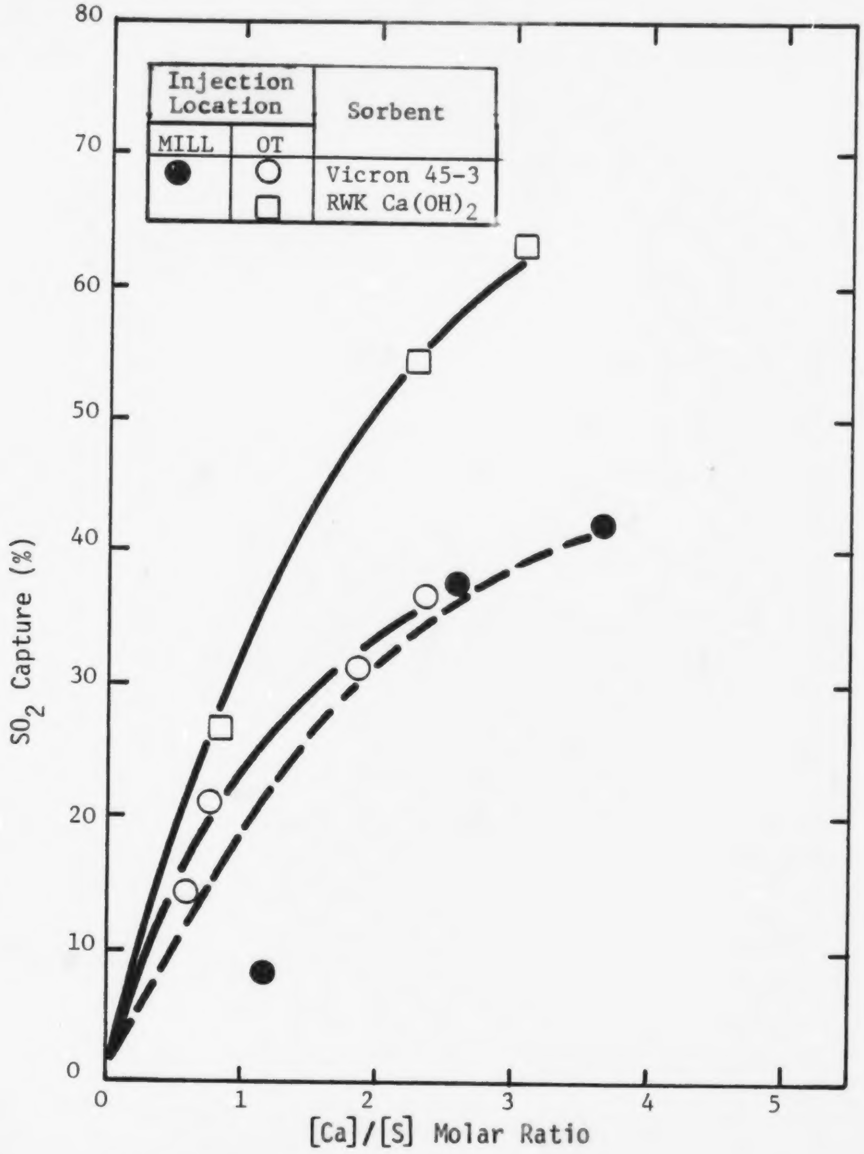


Figure 5-10. Summary of SO_2 capture tests with Indiana coal using the optimized SM-II burner.

The tests with the Saar coal were conducted using the SM-II burner with small diameter inner tertiary ports. These test results are shown in Figure 5-11. The RWK $Ca(OH)_2$ achieved the highest SO_2 capture, although significantly less than with either the Utah or Indiana coals, only 33 percent at a Ca/S molar ratio of 2. Injection location had very little effect on the capture achieved with the Vicron limestone. SO_2 emissions were reduced about 24 percent at a Ca/S molar ratio of 2 with the limestone, which is also lower than the SO_2 capture achieved with Utah coal at similar conditions (29 percent).

The trends for all three fuels were similar, with the best performance in terms of SO_2 capture achieved by injecting RWK $Ca(OH)_2$ through the outer tertiary ports and with little difference in the effectiveness of injection location with Vicron. Figure 5-12 presents the Utah and Indiana data for the optimized SM burner on the basis of sorbent/injection location combination to illustrate the effect of fuel composition. Data for Saar coal is not presented because program limitations prevented completion of sorbent tests of Saar coal with this burner configuration. However, the SO_2 capture trends with the Saar coal have been shown to be similar to the other two fuels for the other burner configurations tested. For each combination of sorbent and injection configuration presented, sulfur capture is an average of approximately 4 percent higher with the higher sulfur content Indiana coal than with the Utah coal. Intuitively, an effect of composition (sulfur content, in particular) would be expected. The sulfation reaction would be thought to be driven in part by the concentration of sulfur species.

5.3 Comparison of the SO_2 Reduction of the Weiher SM Burner and the Optimized SM-II Burner

Sulfur dioxide capture with the various SM configurations tested can be compared in two ways. First, both the Weiher SM burner and the SM-II design were tested with similar tertiary air configurations, specifically, with the large diameter (255 mm) inner ports. Any differences in SO_2 capture would be related only to the secondary air velocity modification. The other comparison that can be made is to consider the Weiher SM burner and the

Nominal Conditions
Coal = Saar
Firing Rate = 100.7±0.9 x 10^6 Btu/hr
SR_B = 79±1.0% TA
SR_T = 125±2.0% TA
Swirl Setting = 4.5
Core Valve = 45° Open
Tertiary Air Location = Inner
Tertiary Port Diameter = 210mm
Sorbent Injection Velocity = 115 ft/sec.

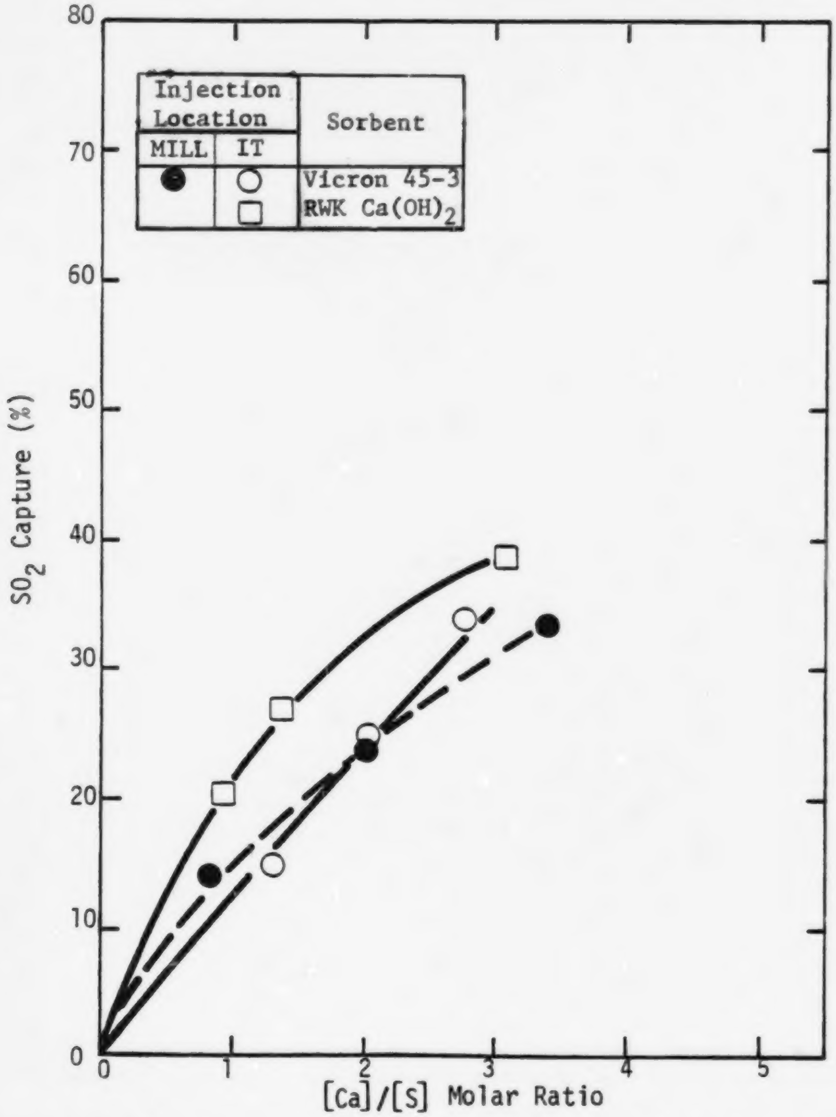
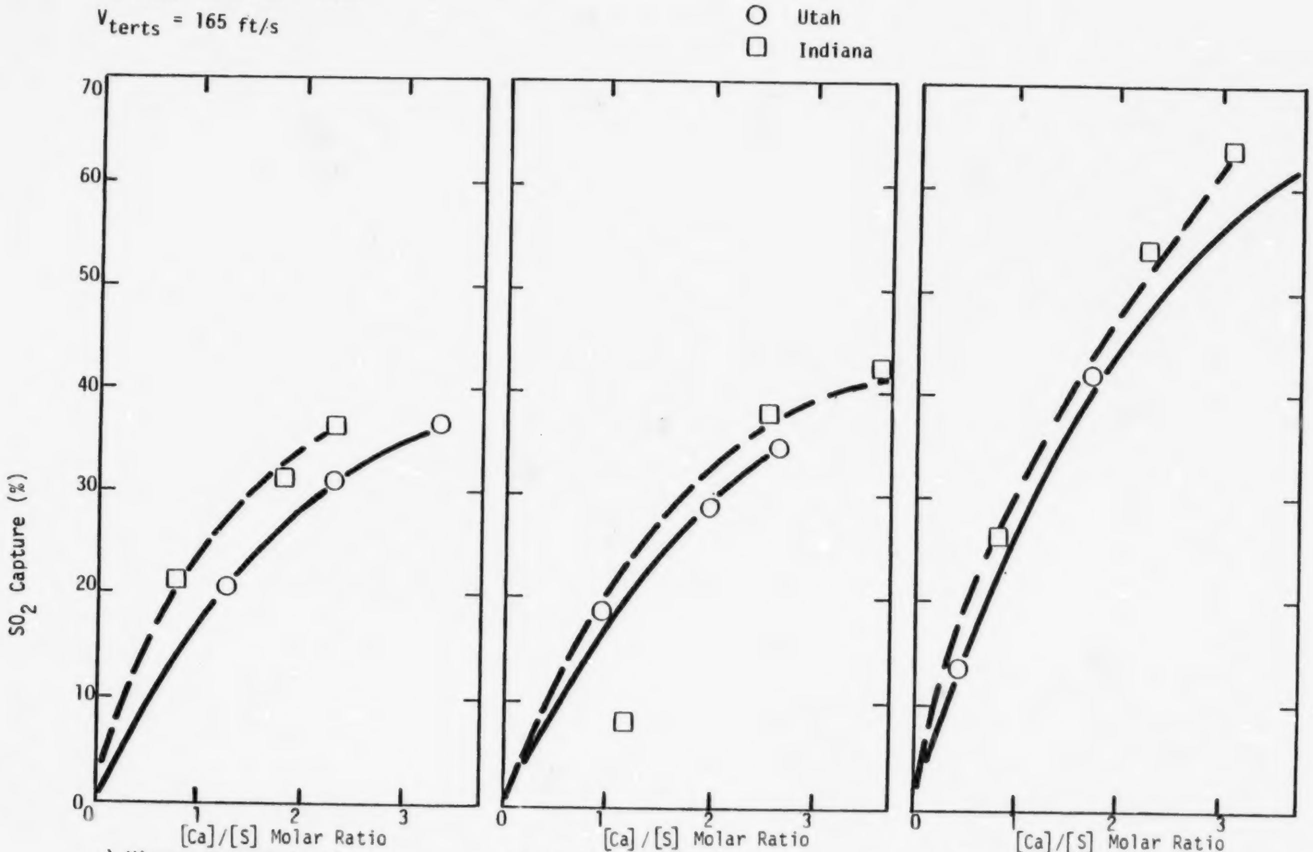


Figure 5-11. Summary of SO_2 capture tests with Saar coal using the SM-II burner.



a) Vicron through tertiary ports

b) Vicron with coal

c) RWK lime through tertiary ports

Nominal Conditions

Firing Rate = 100.7±1.5 x 10^6 Btu/hr
SR_B 79.7±2.0% TA
SR_T 125±1.0% TA
Tertiary Location = Outer
V_{terts} = 165 ft/s

Figure 5-12. Effect of coal composition on SO_2 capture with the optimized SM-II burner.

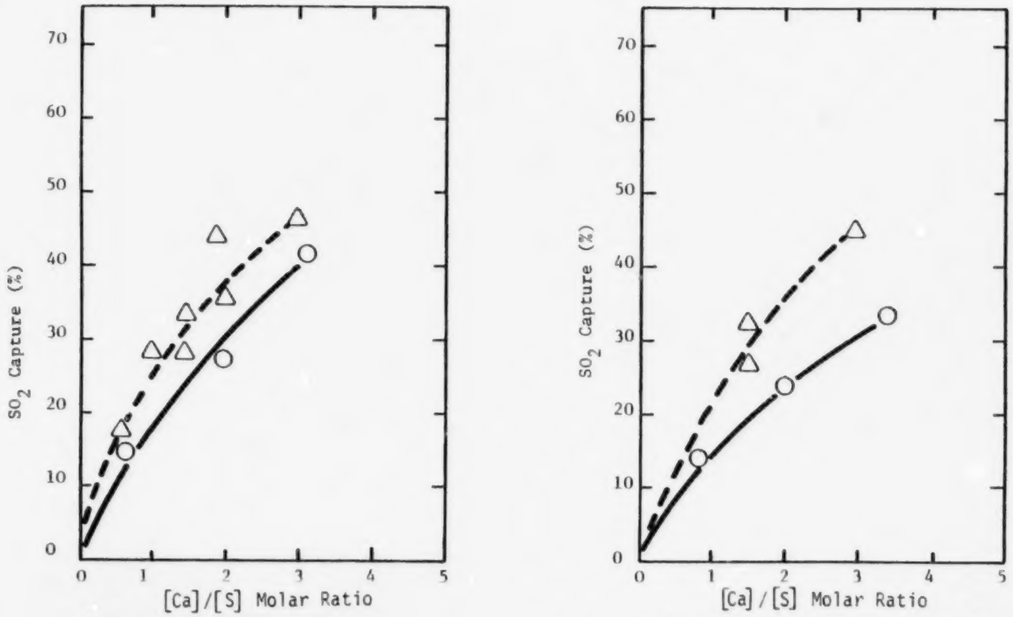
optimized SM-II burner, basing comparisons on performance rather than hardware similarities. The two burners with similar tertiary air configurations are compared in Figure 5-13. For the two cases shown in Figure 5-13, sulfur capture was higher with the Weiher SM burner. Injection of the Vicron limestone through the inner tertiary ports achieved about 37 percent SO_2 capture at a Ca/S molar ratio of 2 for the Weiher SM burner and about 31 percent for the SM-II burner. The difference in capture was even greater for Vicron injected with the Saar coal, with 36 percent capture for the baseline Weiher SM burner at a Ca/S molar ratio of 2 and 24 percent for the SM-II burner with similar tertiary geometry. For the Saar coal tests, however, there was a significant difference in test conditions, namely burner zone stoichiometry, that could affect direct comparison. The burner zone stoichiometry was much lower for the SM-II burner (79 percent T.A.) than for the Weiher burner tests (89 percent T.A.). Burner performance, particularly NO_x emissions, is sensitive to burner zone stoichiometry and, thus, may affect SO_2 capture. For the Weiher SM burner, the effect of staging on sulfur dioxide capture was mixed. For the U.S. coals, unstaged conditions resulted in slightly higher captures, but the reverse was true for the Saar coal.

Sulfur dioxide capture for the optimum SM-II burner design, which incorporates the smaller diameter outer ports, is compared with the Weiher SM burner for corresponding test conditions with Indiana coals in Figure 5-14. Capture with the Vicron limestone was essentially the same for the two burner designs for both inmjection with the tertiary air and with the coal. Both burners achieved about 33 percent SO_2 reduction at a Ca/S molar ratio of 2 with Vicron through the tertiary ports and 30 percent reduction when Vicron was added to the coal. The RWK hydrated lime injected through the tertiary air ports was the most effective sorbent for both burners, but SO_2 capture was much higher for the optimized SM-II burner with about 50 percent reduction compared to only 35 percent for the Weiher burner. The Weiher burner, however, was able to achieve well over 40 percent capture with the hydrated lime for the Utah and Saar coals, which was comparable with the optimized SM-II burner.

Nominal Conditions
Tertiary Air Locations = Inner
Tertiary Port Diameter = 255mm
Sorbent = Vicron 45-3

	Burner	Firing Rate (10^6 Btu/hr)	SR_B (% TA)	SR_T (% TA)
△	Weiher	101.5±2.7	84±2.0	128±2.0
○	SM-II	100.6±1.6	80±1.0	125±1.0

	Burner	Firing Rate (10^6 Btu/hr)	SR_B (% TA)	SR_T (% TA)
△	Weiher	101.6±1.3	89±1.0	125±2.0
○	SM-II	100.7±0.9	79±1.0	125±2.0



a) Utah coal - Inner tertiary Vicron Injection

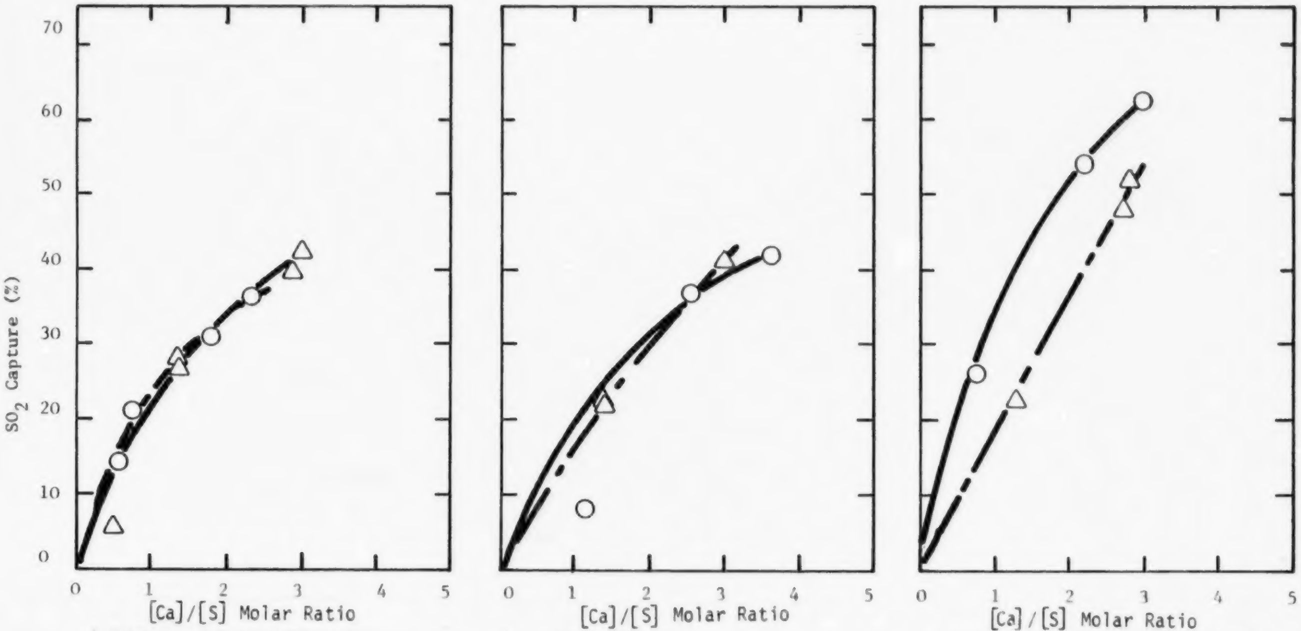
b) Saar coal - Vicron injected with coal

Figure 5-13. Comparison of SO_2 reduction with the Weiher SM and SM-II burners with large diameter inner tertiary air ports.

Nominal Conditions

Coal = Indiana

	Burner	Tertiary Air Location	Tertiary Port Diameter (mm)	Firing Rate (10^6 Btu/hr)	SR_B (%TA)	SR_T (%TA)
△	Weiher	Inner	255	103.6±1.8	78±2.0	123±2.0
○	SM-II	Outer	210	101.3±3.0	80±2.5	124±2.0



a) Vicron with tertiary air

b) Vicron with coal

c) RWK $Ca(OH)_2$ with tertiary air

Figure 5-14. Comparison of SO_2 reduction with Weiher SM burner and optimized SM-II burner.

During the Weiher SM burner sorbent tests NO_x emissions increased when limestone was injected with the coal. The increase in NO_x appeared to be proportional to the sorbent injection rate, ranging from 5 to 15 percent over the baseline NO_x emissions as sorbent flow increased. This effect occurred to a much lesser degree with the U.S. coals. The additional air for sorbent transport added to the coal/primary stream is very small resulting in a neglible increase in the primary stoichiometry. The proportional increase in NO_x with sorbent feed rate suggest an effect on combustion chemistry that is as yet not understood. No measurable change in NO_x emissions occurred during the sorbent injection tests with the optimized SM-II burner.

6.0 CHARACTERIZATION OF THE SM BURNERS

Detailed measurements were performed for selected conditions to obtain data characterizing the performance of the SM burners tested, both with and without sorbent injection. These measurements included:

1. Relative mass loading of fly ash
2. Size distribution of fly ash particles
3. Fly ash composition
4. Slagging and fouling characteristics
5. Flue gas SO_3 concentration

The measurement of fly ash mass loading, fly ash size distribution, and flue gas SO_3 concentration are time and labor intensive, requiring constant conditions during the sampling process. While performed at selected test conditions during the Phase I tests of the Weiher SM burner, the limited testing time allocated for the SM-II burner optimization tests of Phase II was not sufficient to include these manual measurements. Detailed laboratory analyses of the fly ash composition were only performed during the Phase I tests. Problems with the sampling apparatus resulted in contamination of fly ash samples during Phase II, so that only routine loss on ignition (LOI) and ultimate analyses could be performed for the Phase II ash samples.

6.1 Fly Ash Characterization

The physical and chemical properties of selected fly ash samples from the Phase I Weiher burner are listed in Table 6-1. These samples allow comparison among unstaged and staged conditions without sorbent and staged conditions with sorbent. The analyses performed on these samples included measurements of relative mass loading, size distribution, elemental analysis, and ash melting characteristics.

TABLE 6-1 SUMMARY OF PHASE I DETAILED FLY ASH ANALYSES (AS RECEIVED BASIS)

			U77	U31	U72	S42	S8-9	S13	I 11	I3	I14
Test No.			U77	U31	U72	S42	S8-9	S13	I 11	I3	I14
Coal			Utah	Utah	Utah	Saar	Saar	Saar	Ind.	Ind.	Ind.
Load (MW)			29.5	31.1	29.5	30.5	30.3	29.7	31.0	28.6	30.6
SR_B(%TA)			81	115	85	89	115	88	82	116	78
SR_T(%TA)			126	123	129	127	122	121	128	127	123
Sorbent					Vicron			Vicron			Vicron
Inj. Loc.					IT			IT			IT
Ca/S					2.97			2.96			2.94
ΔSO_2(%)					46.1			44.0			40.0
Ultimate Analysis (%)	H_2O		<0.01	0.03	<0.01	0.01	0.01	<0.01	0.01	0.03	<0.01
	C		7.24	10.48	4.37	25.46	33.11	27.85	10.08	10.71	6.04
	H		0.39	0.89	0.39	0.54	0.50	0.53	0.32	0.65	0.29
	N		0.07	0.17	0.02	0.29	0.42	0.17	0.10	0.14	0.10
	S		2.24	2.96	2.16	1.35	0.71	1.47	1.55	3.20	2.24
	Ash		90.55	83.03	93.83	72.25	63.63	68.07	87.90	82.56	92.15
	O		<0.01	2.44	<0.01	0.10	1.62	1.91	0.04	2.71	<0.01
	CO_3		1.38	0.48	1.69	0.93	0.44	1.53	1.18	1.95	1.14
Elemental Ash (%)	SiO_2		47.83	49.66	46.31	41.15	44.72	34.27	50.08	43.89	34.22
	Al_2O_3		18.69	21.52	16.18	23.24	25.50	20.54	22.39	20.90	16.84
	TiO_2		0.67	1.01	0.71	0.67	0.86	0.65	0.86	0.83	0.64
	Fe_2O_3		7.19	6.14	3.60	8.09	9.77	7.12	7.80	8.29	7.17
	CaO		15.12	11.05	24.99	14.17	7.38	23.00	9.21	11.83	29.27
	MgO		1.03	1.74	1.62	2.69	2.97	2.50	0.87	1.61	1.18
	K_2O		1.13	0.76	0.81	2.84	3.11	2.31	1.80	2.08	1.31
	Na_2O		0.44	0.84	0.46	0.49	0.57	0.38	0.44	0.64	0.26
	SO_3		6.43	9.15	6.08	4.97	2.80	5.69	4.60	9.76	6.69
	P_2O_5		0.24	1.05	0.28	0.11	0.17	0.18	0.29	0.28	0.18
Ash Fusion Temp. (°F)	Red.	IDT	2140	2170	2100	2280	2255	2100	2235	2200	2090
		ST	2210	2275	2130	2300	2275	2140	2275	2240	2100
		HT	2320	2380	2175	2340	2340	2160	2330	2295	2115
		FT	>2700	2625	2310	2615	2540	2200	>2700	2495	2290
	Oxid.	IDT	2335	2300	2115	2290	2360	2150	2345	2205	2105
		ST	2365	2345	2150	2400	2400	2200	2400	2390	2140
		HT	2400	2390	2180	2440	2440	2215	2440	2410	2160
		FT	>2700	>2700	>2700	>2700	2650	2380	>2700	2640	2480
Surface Area (m^2/gr)			3.71	3.57	3.57	7.21	23.31	14.63	6.05	6.08	4.94
LOI 500°C(%)			6.8	16.1	1.9	24.8	36.7	26.7	10.9	17.0	4.9
LOI @ 1000°C (%)			10.1	18.4	7.0	28.5	37.4	33.3	13.0	19.4	9.0
Hydration Wt Gain(%)			26.1	5.3	26.0	23.1	12.8	22.6	14.9	2.0	29.1
Mass Median Dia. (μm)			14	10	14	12	9.7	12	9.2	10	12
Loading @ 0% O_2(g/dsm^3)			9.45	8.38	14.73	10.61	12.50	17.47	11.27	12.36	24.01

6.1.1 Relative Particulate Mass Loading

Measurement of particle loading was made using the in-situ solids probe described in Section 3.4. The measurements should be used only for relative comparison for the following reasons:

1. Sampling was conducted at a single point in the center of the LWS duct, 8 duct diameters (48 ft.) from the furnace exit.

2. Sampling was consistently less than isokinetic (84 ± 7.5% isokinetic) due to fixed nozzle size.

3. The blunt-nose shape of the probe was not the sharp edge-tapered nozzle generally specified for isokinetic flow, probably resulting in diverging streamlines around the probe. This water-cooled probe was used because of the high temperatures (~1300F) existing at the sample location, quenching any reactions within the filter assembly.

With these caveats, the relative mass loadings may be useful in estimating the change in distribution of ash through the boiler among bottom ash, convective pass deposits, and fly ash. Relative loading of fly ash was determined for nominal full load operation at unstaged, staged, and staged with Vicron injection at a Ca/S molar ratio = 3 through the inner tertiary ports for all three test fuels. The data are listed in Table 6-2.

The mass loadings of fly ash for the Utah and Indiana coal test conditions are lower than the anticipated theoretical loading based on the composition of coal and estimates for the fate of the sorbent. For the Saar coal, however, the fly ash samples at staged and unstaged conditions yielded higher than the anticipated mass loadings. Because of the non-isokinetic nature of the sample, these absolute comparisons may not be justified. However, comparing the relative difference between the measured and theoretical mass loadings at conditions with and without sorbent injection, a

TABLE 6-2 SUMMARY OF RELATIVE PARTICULATE LOADING FOR SELECTED PHASE I TESTS

	Test No.	U77	U31	U72	S42	S8-9	S-13	I11	I 3	I 14
Test Conditions	Coal	Utah	Utah	Utah	Saar	Saar	Saar	Ind.	Ind.	Ind.
	Load (MW)	29.5	31.1	29.5	30.5	30.3	29.7	31.0	28.6	30.6
	SR_B (%TA)	81	115	85	89	115	88	82	116	78
	SR_T (%TA)	126	123	129	127	122	121	128	127	123
	Sorbent	---	---	Vicron	---	---	Vicron	---	---	Vicron
	Injection Location	---	---	IT	---	---	IT	---	---	IT
	Ca/S Molar Ratio	---	---	2.97	---	---	2.96	---	---	2.94
Theoretical Mass * Loading @ 0% O_2 (g/m^3)		12.21	12.21	26.30	10.00	10.00	21.33	12.89	12.89	31.84
Measured Mass Loading @ 0% O_2 (g/m^3)		9.45	8.34	14.73	10.61	12.50	17.47	11.27	12.36	24.01
Isokinetic Rate (%)		87	82	90	84	78	88	88	101	84

* Based on coal composition and fate of sorbent, where applicable.

Fate of sorbent assumptions:

1. Vicron 45-3 = 99% $CaCO_3$ + 1% Ash.
2. 80% Calcination of $CaCO_3$.
3. All sulfur in the ash is bound as $CaSO_4$.
4. All sorbent not utilized is in the form of CaO.

significantly lower fraction of the theoretical loading was collected for conditions with sorbent injection for all three coals. For Utah coal, the tests without sorbent yielded an average of 73 percent of theoretical loading compared to 56 percent for sorbent tests. Similar differences were measured for Saar coal, 116 percent of theoretical loading without sorbent and only 82 percent with sorbent, and for Indiana coal, 92 percent without sorbent and 75 percent with sorbent. This implies that a greater portion of the solid material is retained in the furnace when sorbent material is added. This would be an important consideration in field application of the sorbent injection technology, where the capacity of an operating boiler's solids handling would have to be increased.

6.1.2 Fly Ash Particle Size Distribution

Particle size distribution was determined by an independent laboratory using x-ray sedimentation on samples obtained with the high volume sampling system. Again, the sample obtained was not necessarily isokinetic, but the large diameter nozzle and high volumetric sample rate yield a representative sample of ash from the center of the LWS exhaust duct. Results of the analyses for tests with Utah, Saar, and Indiana coals are presented graphically in Figures 6-1, 6-2, and 6-3, respectively. The test conditions for which the particle size analyses were performed included those listed in Table 6-1. In general, the particle size distribution was very similar for each case. The mass median particle size for unstaged conditions is slightly smaller than for staged conditions with both Utah (10 μm to 14 μm) and Saar coal, (9.7 μm to 12 μm), while the opposite was measured for the Indiana coal (10 μm for unstaged conditions and 9.2 μm for staged conditions). With the addition of Vicron limestone, which itself has a mass median diameter of 9.8 μm, there was essentially no change in particle size from baseline staged conditions for the Utah and Saar coals. For the Indiana coal, however, the particle size increased from 9.2 μm to 12 μm with the addition of Vicron. This indicated that there may be some agglomeration among ash-sorbent or sorbent-sorbent particles for the Indiana coal.

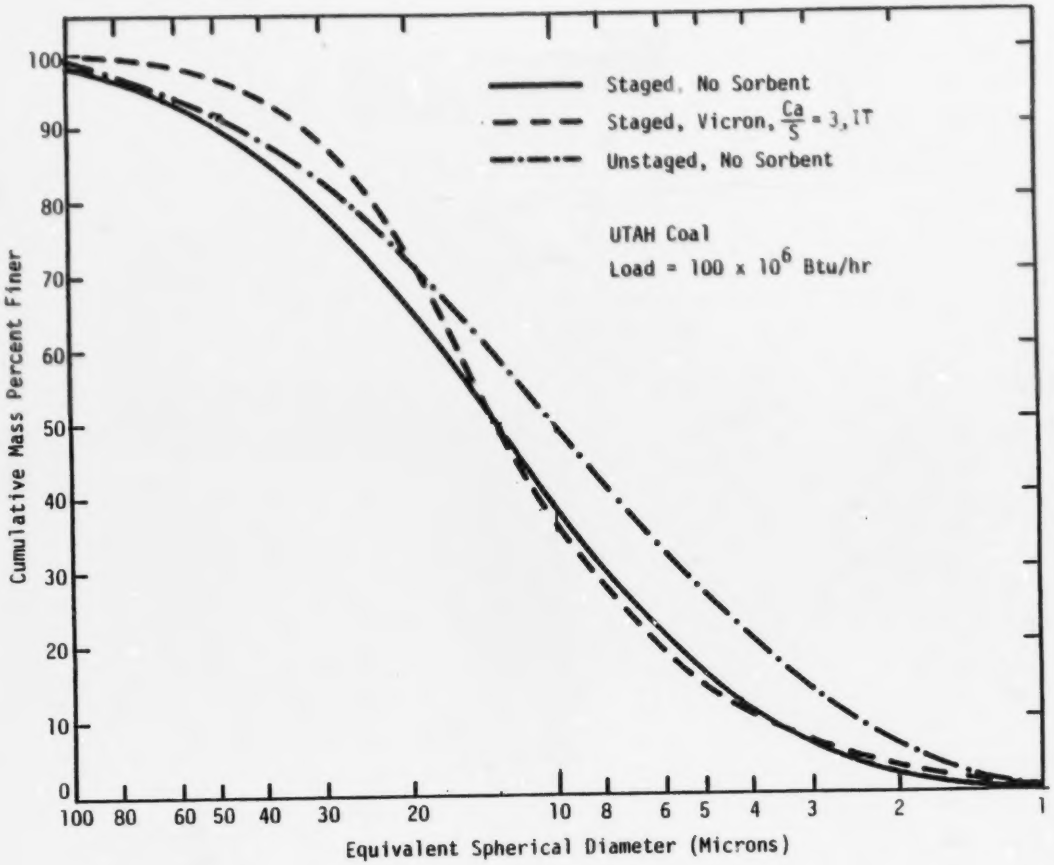


Figure 6-1. Particle size distribution for Utah with Weiher SM burner.

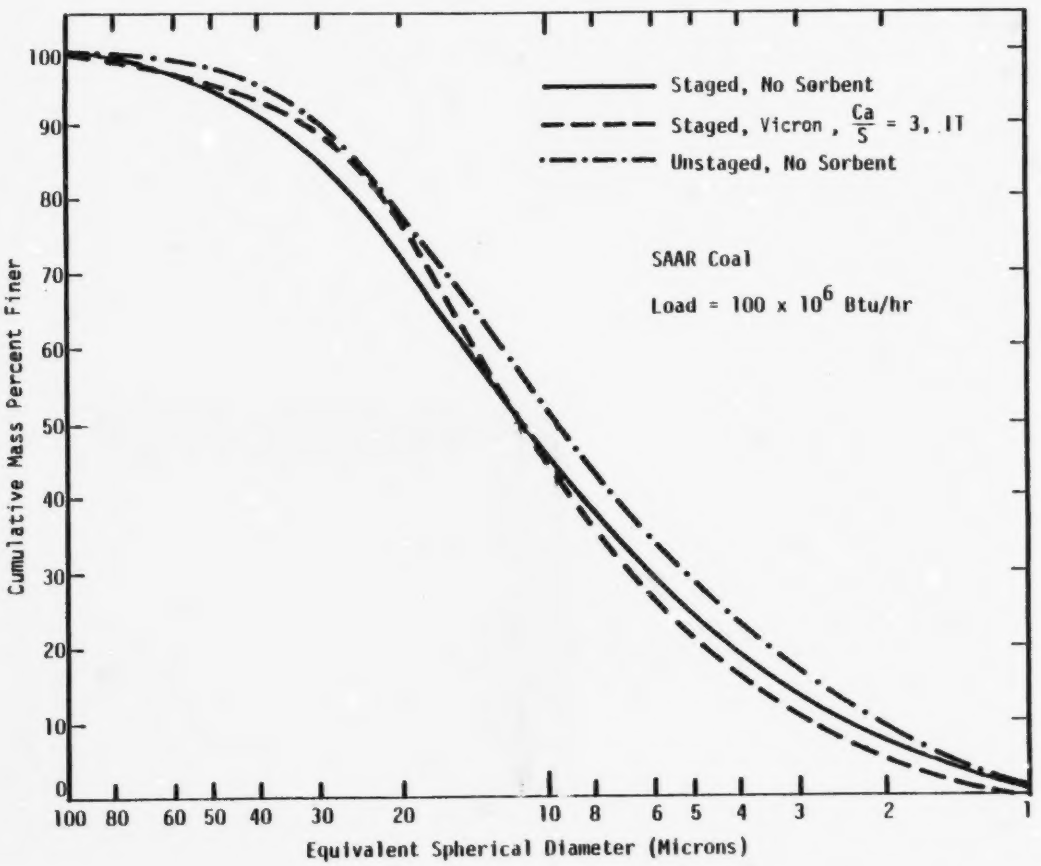


Figure 6-2. Particle size distribution for Saar coal with Weiher SM burner.

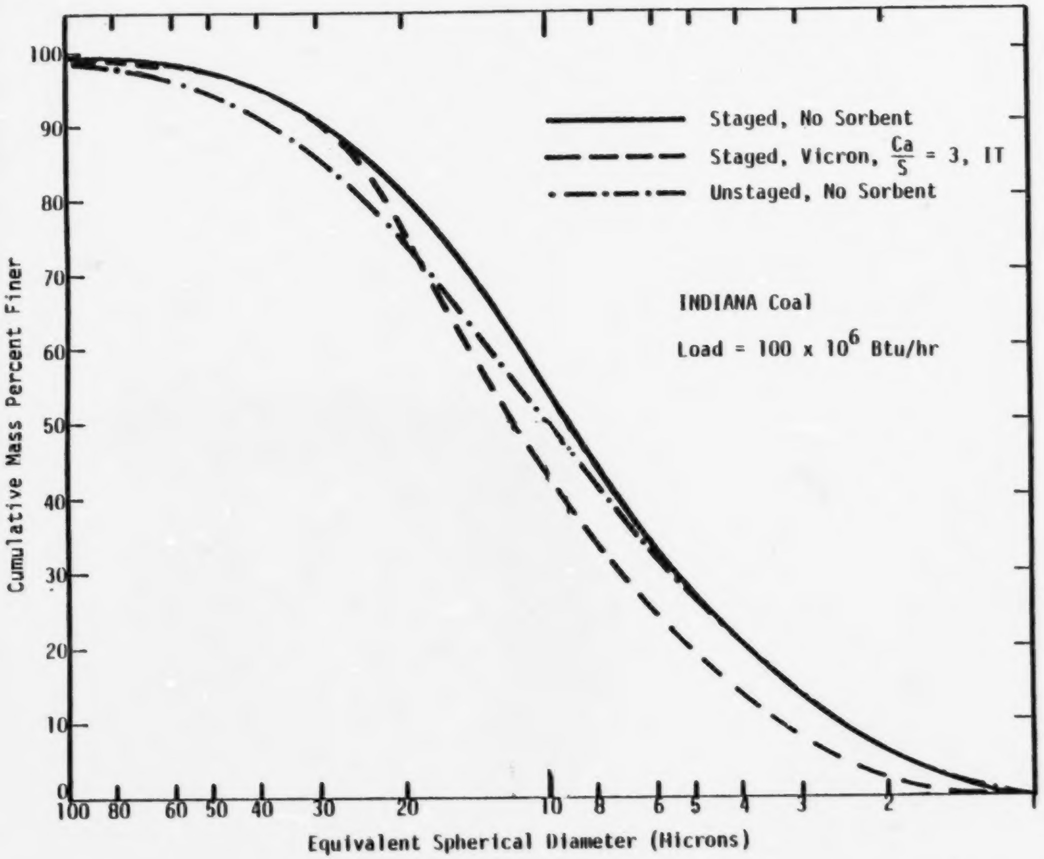


Figure 6-3. Particle size distribution for Indiana coal with Weiher SM burner.

6.1.3 Laboratory Analysis of Ash Composition

Table 6-1 summarizes the analyses performed on the ash for selected Weiher SM burner test conditions. The samples from the tests without sorbent, both staged and unstaged, for the two U.S. coals have relatively low carbon content, 7.24-10.71 percent. This is an indication of efficient combustion, resulting in carbon utilization for the test conditions listed of 98.94 percent for Utah coal and 98.41 percent for Indiana coal with the Weiher SM burner. The carbon content of the Saar coal was very high, 25.46 percent, which corresponds to 96.2 percent carbon burnout. For the optimized SM-II burner, carbon burnout was high for all three coals, as listed in Table 4-1, being 98.87 percent for Utah, 98.98 percent for Indiana, and 99.21 percent for Saar coal.

Comparison of the elemental analyses of the ash mineral matter reveals no large variations in composition from staged to unstaged conditions for each coal. However, CaO concentrations from the coal analyses listed in Table 3-1 predict substantially lower levels of CaO than measured in fly ash samples collected for the baseline condition of each coal. This implies that some of the sorbent material may have been retained in the LWS following sorbent injection tests and later re-entrained during baseline conditions. Calcium utilization efficiency can be calculated using the CaO and S content of the ash as well as from the gas phase species alone. The two methods are compared in Table 6-3. The agreement between the two independent methods is generally good.

Ash composition affects the melting characteristics and the tendency of the ash to slag or foul boiler surfaces. Also included in Table 6-1 are ash fusion temperatures under oxidizing and reducing conditions. Reducing conditions are usually compared, since those conditions represent the worst case with lower melting temperatures. The addition of the Vicron limestone resulted in lowering the initial deformation temperatures for each coal, only slightly for the Utah coal (40°F) with a greater effect for the Saar (180°F) and Indiana coals (145°F). The effect of the limestone injection on the various fusion temperatures was greater at elevated temperatures, at which

TABLE 6-3 COMPARISON OF SORBENT UTILIZATION EFFICIENCIES FOR WEIHER SM BURNER TEST

Test No.	U72	S13	I14
Coal	Utah	Saar	Indiana
Load (MW)	29.5	29.7	30.6
SR_B (%TA)	85	88	78
SR_T (%TA)	129	121	123
Sorbent	Vicron	Vicron	Vicron
Injection Location	IT	IT	IT
Ca/S Molar Ratio	2.97	2.96	2.94
Capture (%)	46.1	44.0	40.0
Ash S (%)	2.16	1.47	2.24
Ash CaO(%)	24.99	23.00	29.27
Gas Phase[1] Utilization (%)	15.5	14.9	13.6
Solid Phase[2] Utilization (%)	15.1	11.2	13.4

[1] Gas Phase Utilization = $\left[\dfrac{\text{Gas Phase } SO_2 \text{ Capture (\%)}}{\text{Ca/S}}\right]$

[2] Solid Phase Utilization = $\left[\dfrac{\text{Ash S (\%)}}{\text{Ash CaO (\%)}} \times \dfrac{56}{32} \times 100\%\right]$

point the fluid temperature (FT) decreased by about 400°F for all three coals.

6.2 Slagging and Fouling Characteristics

Deposition of coal particulate matter on boiler surfaces in both the radiant section and convective pass was evaluated during both phases of testing LCS SM burners. Three refractory-faced, water-cooled panels were installed in the LWS along the burner centerline on the south and rear walls to provide deposition surfaces in the radiant zone. An array of six refractory coated, stainless steel tubes, 2 wide x 3 deep, cooled using a radiative heat sink, was installed above the nose of the furnace to simulate tubes in the convective pass. The slagging panels were equipped with thermocouples and a metered water flow so that heat flux through the panels could be monitored. The fouling probe assembly above the LWS nose was equipped with thermocouples and was inspected after each day of testing to determine deposition patterns.

The deposits on the slagging panels were similar for each of the coals under similar operating conditions. The color of the deposits ranged from a grayish tan for the Saar and Utah coals to dark brown for the Indiana coal. The mass deposited tended to vary daily, but this appeared to be caused by the sloughing off of collected material either during cooling or during removal of the panels for inspection. The collected mass during sorbent injection tests was comparable to that collected with no sorbent injection. Two distinct layers formed on the panels. The layer adjacent to the surface of the panels was of a flaky consistency. The outer layer, exposed to higher temperatures, was sintered and consisted of densely packed, 0.125 to 0.5 inch diameter nuggets. These nuggets were friable, but there was no evidence of molten slag.

A typical example of slagging panel surface temperature and heat flux change during testing is shown in Figure 6-4. The slagging panel surface temperature increased initially for tests with and without sorbent, reaching a maximum temperature 2 to 3 hours after coal firing was begun. The surface

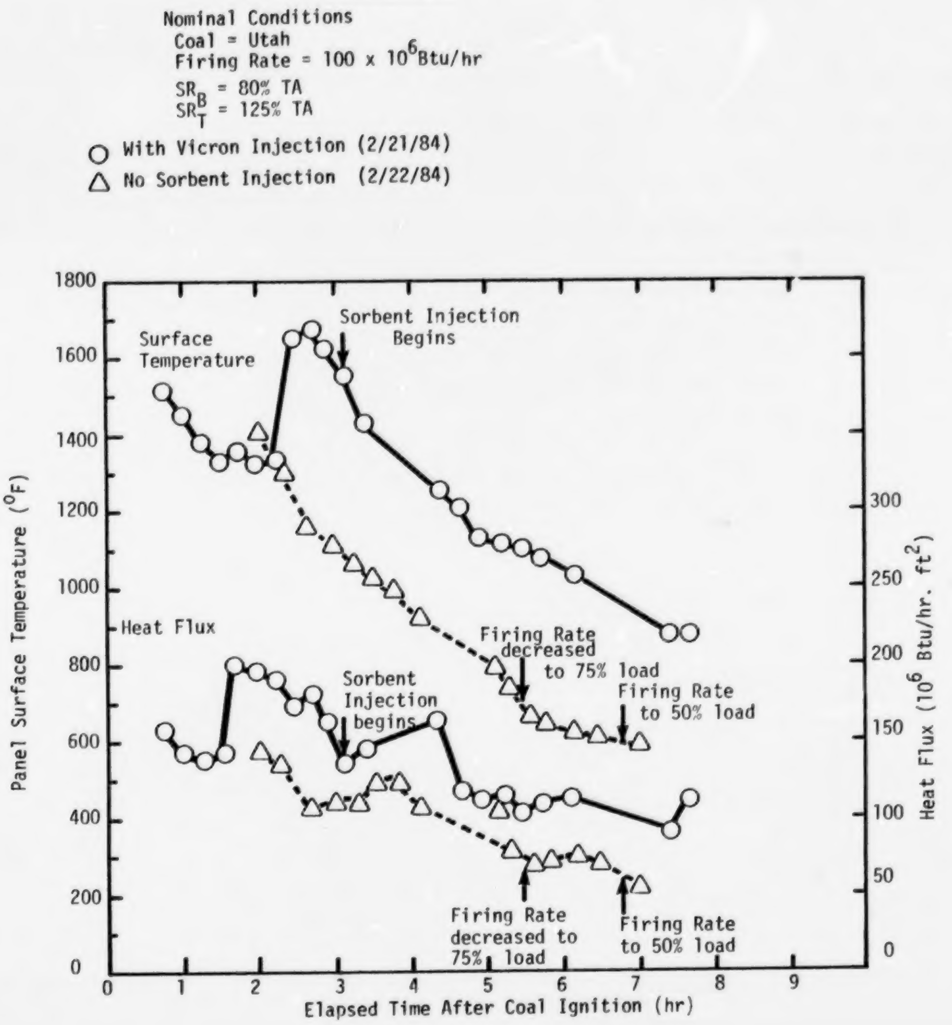


Figure 6-4. Typical daily thermal history of LWS rear wall slagging panel during optimized SM-II burner tests.

temperature then decreased monotonically as the ash layer increase. Although there is a substantial difference in absolute surface temperatures and between tests with and without sorbent injection, the rate of temperature decay is comparable. The difference in absolute panel temperatures is probably due to furnace start-up firing rates for the two test days shown. The calculated heat flux for the two days indicates a slow decay over the test periods. The build up of the ash layer produces a growing insulating layer on the panel, resulting in decreasing heat flux through the slagging panel. The panel heat flux was lower for the day without sorbent injection and is again related to the lower surface temperature caused by start-up differences.

The deposits on the fouling probes above the LWS nose consisted of powdery ash for each of the three coals; however, the pattern of distribution was substantially different. The deposits for the Saar and Utah coals collected on the back of the tubes, while for the Indiana coal the deposits were on the front side. One possible explanation could be the different density of the ashes. The deposits of the Saar coal ash and, in particular, the Utah ash were very light in color, free of iron in appearance. The Indiana coal, on the other hand, produced reddish brown deposits characteristic of iron oxide. Iron oxide has a substantially higher density, 5.24 gm/cc, than the ash from Utah coal, about 2.5 gm/cc. The heavier particles would tend to impact the tubes, not being able to follow the streamlines around the tubes, and collect on the front. The lighter ash particles form the Utah coal would tend to be caught in the recirculating wake of the tubes and thus collect on the back side.

Past researchers have developed indices based on coal ash composition and physical properties. Table 6-4 lists only a few of the many available correlations applied to selected Weiher SM burner test conditions. Similar full load test conditions are considered for each coal: staged and staged with Vicron injected through the inner tertiary ports. In general, the indices imply that the addition of sorbent material would tend to increase the slagging potential of the ash. Ash viscosity temperatures indicate temperatures at which slag flow properties change from Bingham plastic to

TABLE 6-4 INDICES OF SLAGGING AND FOULING POTENTIAL FOR SELECTED TEST CONDITIONS OF THE WEIHER SM BURNER

Test No.	U77	U72	S42	S13	I11	I14
Coal	Utah	Utah	Saar	Saar	Indiana	Indiana
Sorbent	---	Vicron	---	Vicron	----	Vicron
Injection Location	---	IT	---	IT	----	IT
Ca/S	---	2.97	---	2.96	----	2.94
Measured Ash Fusion Temperatures (°F)						
IDT	2140	2100	2280	2100	2235	2090
ST	2210	2130	2300	2140	2275	2100
HT	2320	2175	2340	2160	2330	2115
FT	>2700	2310	2615	2200	>2700	2290
Ash Viscosity Temperature (°F)						
Tcv (°F)	2520	2375	2540	2360	2530	2315
T250 (°F)	2443	2311	2366	2235	2584	2165
Ash Components						
Dolomite Ratio	64.83	84.53	59.62	72.22	50.10	77.70
Base/Acid Ratio	0.37	0.50	0.43	0.64	0.27	0.76
Ash Type	Lignite	Lignite	Lignite	Lignite	Lignite	Lignite
Slagging/Fouling Indices						
Fouling Index[a]	Low	Low	Low	Low	Low	Low
Fouling Index[b] (RF)	N/A	N/A	N/A	N/A	0.12	0.20
Slagging Potential (RS)[c]	2192	2116	2312	2123	2276	2104
Predicted ST (°F, Red.)						
Gauger[3]	2350	2330	2290	N/A	2350	N/A
Sondreal and Ellman[4]	2234	2299	2192	2197	2290	2236
Bryers and Taylor[5]	2033	1845	N/A	N/A	2487	2170

Slagging/Fouling Indices[6]

a. Based on Na_2O content in ASTM ash for coals with lignite and bituminous ash.

b. RF = Base/Acid Ratio x Na_2O for eastern U.S. coals.

c. RS = $\left[(\text{max. HT}) + 4\ (\text{min. IDT})\right]/5$ for lignitic ashes.

Newtonian (T_{cv}) and at which the slag will flow on a vertical wall with a viscosity of 250 poise (T_{250}). Dolomite ratio and Base/Acid ratio are indices of the basic constituents of the ash and have been used to predict ash viscosity properties. In general, an increase in Dolomite ratio increases the slag viscosity.

Ash type is characterized as lignitic when the Fe_2O_3 concentration is less than MgO + CaO and as bituminous ashes when the Fe_2O_3 content is greater than MgO + CaO. These designations are used to separate correlations for eastern and western coals. Fouling indices included in Table 6-4 are based primarily on ash type and sodium (Na_2O) content. Although the RF index applies to eastern coals, the ash samples for the Indiana coal, I 11 and I 14 have a composition which is characterized as lignitic. This probably makes the RF index not applicable. RF indices of less than 0.2 are classified as low fouling ashes, while ashes between 0.2 and 0.5 are medium fouling. For lignitic ashes, slagging severity is classed as medium for slagging potential (RS) between 2250 and 2450 and as high for RS between 2100 to 2250.

The predicted ash softening temperatures developed by previous researchers are based on ash composition. The correlations were derived from different coal data bases, but all include bituminous and some lignitic coals of the United States. In general, these correlations imply that with the addition of calcium-based sorbents, the predicted softening temperatures decrease. ASTM measured softening temperatures, also included in Table 6-4, do not necessarily match the predicted values. This may be due to considerable scatter in the data upon which the correlations were based. Low ash softening temperature is an indication that slagging and fouling may cause problems. Softening temperature, often referred to as the ash fusion temperature, is the temperature most often used for boiler design purposes to avoid slagging and fouling.

6.3 Concentration of SO_x Species

The two principal gas phase sulfur species for pulverized coal combustion systems are SO_2 and SO_3, both of which were measured for selected test conditions. SO_2 was routinely measured during sorbent injection tests utilizing the duPont NDUV continuous SO_2 monitor and sampling system described in Section 3.4. As an independent check of the continuous monitor system, measurements of SO_2 were made using EPA Method 6 for selected test conditions. These measurements are presented in detail in Appendix A, the program quality assurance summary. Limited measurements were made during the Weiher SM burner tests for SO_3 using the sampling method of controlled condensation. Results for some of the key test conditions are summarized in Table 6-5. The levels of SO_3 were all less than one percent of the measured SO_2 concentration, which is typical for SO_3 levels in field operating systems. Because of the accuracy of the method, SO_3 levels less than 1 ppm are usually considered to be essentially zero.

TABLE 6-5 MEASURED LEVELS OF SO_2 AND SO_3 WITH AND WITHOUT SORBENT INJECTION DURING TESTS OF THE WEIHER SM BURNER

Test No.	U42	U72	S8-9	I 11	I 3	I 14
Coal	Utah	Utah	Saar	Indiana	Indiana	Indiana
Load (MW)	31.0	29.5	30.3	31.0	28.6	30.6
SR_B (% TA)	82	85	115	82	116	78
SR_T (% TA)	124	129	122	128	127	123
Sorbent	---	Vicron	---	---	---	Vicron
Injection Location	---	IT	---	---	---	It
Ca/S Molar Ratio	---	2.97	---	---	---	2.94
SO_3 [a] @ 0% O_2, dry (ppm)	0.33	0.59	0.10	5.5	4.7	0.33
SO_2 [b] @ 0% O_2, dry (ppm)	333	288	591	941	991	620

[a] SO_3 by Controlled Condensation

[b] SO_2 by EPA Reference Method 6

7.0 CONCLUSIONS

The L&C Steinmüller SM burner was evaluated in the EPA LWS for combined NO_x and SO_2 control. The testing involved two burners, designed for a nominal capacity of 100 x 10^6 Btu/hr. One burner was an SM burner scaled to match the design of the 235 x 10^6 Btu/hr SM burners installed at the Weiher III boiler. This Weiher SM burner established a basis for comparing performance in the LWS with an operating boiler. This SM burner was then iteratively modified, incorporating various burner hardware components, to optimize burner performance for low emissions, flame stability, and high combustion efficiency. This second generation SM burner (SM-II) development included modifications of secondary and tertiary air velocity, tertiary air location, and coal nozzle configuration.

The two SM burner designs were tested with three different coals, including the coal used at the Weiher boiler in Germany. SO_2 reduction potential by the injection of calcium-based sorbents through burner passages was evaluated with limestone and hydrated line. Detailed measurements were performed at selected conditions to characterize burner performance.

7.1 Burner Performance and NO_x Emissions

7.1.1 Weiher III SM Burner

The Weiher SM burner design is very simple having a single adjustable parameter, the secondary air swirler. The position of the swirler, and resulting degree of secondary air swirl generated, had little effect on emissions over most of its range; however NO_x emissions increased about 100 ppm to 550 ppm at the maximum swirl position. For stable full load operating conditions, the flame length was about 21 feet with the ignition point at the burner exit. General operation of the test burner was observed to be typical of the SM burners at Weiher.

Emissions from the Weiher SM burner were sensitive to both the degree of staging and excess air levels. The rate of decrease in NO_x emissions ranged from 5 to 7.5 ppm per percent theoretical air change in the burner zone stoichiometry. The effect of excess air change was slightly greater, 9 to 15 ppm decrease in NO_x for each percent theoretical air decrease. At nominal design point conditions (SR_B = 80% TA, SR_T = 125% TA), NO_x emissions were 415, 450, and 570 ppm for Utah, Saar, and Indiana coal, respectively.

7.1.2 SM-II Burner

The SM-II burner was optimized using both the adjustable burner parameters and hardware modifications to the burner geometry. The effect of each parameter evaluated is summarized below.

Secondary Air Swirl. The position of the swirl vane device, and the resulting degree of secondary air swirl generated, had negligible effect on emissions as long as flame stability was maintained. However, decreasing swirl resulted in progressively increasing flame length and flame detachment.

Core Air Flow. Increasing core air flow generally decreased NO_x emissions with no significant effect on combustion efficiency as measured by CO levels. At the highest flow through the core air passage, flame length and detachment increased.

Secondary Air Velocity. Increasing the secondary air velocity with an insert installed in the throat of the Weiher SM burner had no significant effect on emissions. Flame stability was improved to allow stable operation at lower burner zone stoichiometry.

Tertiary Port Location. Of the two locations tested, the set of tertiary air ports further from the burner centerline produced lower NO_x emissions, with the difference becoming greater at lower burner zone stoichiometry.

Tertiary Air Velocity. Tertiary velocity was varied using inserts in the ports that increased the velocity by about fifty percent. For both the inner and outer port locations, the higher tertiary air velocity, i.e. smaller port diameter, produced lower NO_x emissions. Again the difference in emissions became greater as staging was increased.

Coal Nozzle Design. Two inserts for the annular coal nozzle were evaluated. A variable blockage device which divided the coal stream and increased the primary velocity produced a narrow flame which reduced NO_x under unstaged conditions. Staging this configuration significantly increased CO emissions. This device also resulted in a much higher pressure drop across the coal nozzle which caused operational problems for the pulverizer and primary air system. A venturi-shaped insert increased NO_x emissions along with flame stand off. Best overall performance was achieved with the baseline annular coal nozzle.

The optimized configuration of the SM-II burner incorporated the following hardware:

- Secondary air insert
- Baseline annular coal nozzle
- Outer tertiary port location
- Small diameter, high velocity tertiary air ports.

This configuration produced stable full load flames about 21 feet long. NO_x emissions at full load design point conditions (SR_B = 80% TA, SR_T = 125% TA) for this optimized SM-II burner were 370, 370, and 500 ppm for Utah, Saar, and Indiana coals, respectively. Emissions from the SM-II burner were also sensitive to burner zone stoichiometry and overall excess air. The nominal rate of change in NO_x with burner zone stoichiometry was about 10 ppm per percent theoretical air change. The effect of excess air was less, about 6.5 ppm decrease in NO_x for each percent change in excess air.

7.1.3 Comparison of Weiher SM and SM-II Burners

Overall performance of the basic Weiher SM burner was improved with the optimum hardware. NO_x emissions were lower at design point conditions and combustion efficiency was higher. The range of operation, including excess air and turndown, was maintained if not improved. Range of operation could probably be further improved by design changes in secondary swirl generation. Increasing swirl would allow staged operation over the entire load range with stable, attached flames.

The NO_x emissions from the optimum SM-II design were more sensitive to burner zone stoichiometry than the Weiher burner, while the effect of excess air on emissions was much less for the optimized burner. Combustion efficiency with the Saar coal was improved with the optimized burner.

7.2 Sulfur Dioxide Control

7.2.1 Weiher SM Burner

The SO_2 reduction tests with sorbent injection for the Weiher SM burner utilized three sorbents, three injection locations, and three coals. The sorbents, two limestones and a hydrated lime, were injected with the coal at the pulverizer outlet, through nozzles located on the axis of the inner tertiary air ports, and, through nozzles located on the axis of the outer tertiary ports. For the Weiher SM burner configuration, tertiary air flowed through the inner set of ports only. Most of the SO_2 tests were conducted with the Saar coal to obtain data for comparison with sorbent injection tests planned at the Weiher III boiler.

The two limestone sorbents, the Vicron and the RWK $CaCO_3$, achieved similar SO_2 reduction when injected with the Saar coal, 35 percent and 32 percent at a Ca/S molar ratio of 2, respectively. Sulfur capture with RWK hydrated lime injected with the coal was lower, particularly for Ca/S molar ratios greater than 2. Greater SO_2 reduction was achieved with the injection of the hydrated lime through either the inner or outer tertiary ports with 49 percent and 54 percent capture at a Ca/S molar ratio of 2, respectively. Capture with the Vicron and RWK limestones was again similar for injection through the inner tertiary air ports, about 32 percent at a Ca/S molar ratio of 2. However, injection through the outer tertiary ports resulted in substantially higher capture with the Vicron limestone (40 percent at a Ca/S molar ratio of 2) than with the RWK limestone (29 percent).

The trends for SO_2 reduction were similar for the two U.S. coals with the Weiher burner. Highest capture was achieved with the RWK $Ca(OH)_2$ injected through the inner tertiary ports, with 49 percent capture at a Ca/S molar ratio of 2 for Utah coal and 35 percent for Indiana coal. Injection of Vicron through the tertiary ports yielded higher SO_2 capture than injection with the coal, about 35 percent to 30 percent, respectively, for both U.S. coals.

7.2.2 SM-II Burner

The potential for SO_2 reduction for the SM-II burner were conducted with two sorbents; Vicron limestone and RWK $Ca(OH)_2$, through three injection locations; with the coal, through the inner tertiary ports, and through the outer tertiary ports. Sorbent was injected only through the tertiary ports through which the air flowed.

The trends for all three fuels with the optimized SM burner were similar, with the best performance in terms of sulfur dioxide capture achieved by injecting RWK $Ca(OH)_2$ through the outer tertiary ports and with little difference in the effectiveness of injection location for the Vicron limestone. Levels of SO_2 capture at a Ca/S molar ratio of 2 for the higher sulfur content Indiana coal were 50 percent with the RWK $Ca(OH)_2$ through the outer tertiary ports, 33 percent with Vicron through the outer tertiary ports, and 30 percent when Vicron was injected with the coal. For each combination of sorbent and injection configuration, sulfur capture is an average of approximately 4 percent higher with the higher sulfur content Indiana coal than with the Utah coal. Intuitively, an effect of composition (sulfur content, in particular) would be expected. The sulfation reaction would be thought to be driven in part by the concentration of sulfur species.

7.2.3 Comparison of Weiher SM and SM-II Burners

In general, the trends in SO_2 capture for various sorbent and injection locations for the Weiher and optimized SM burner were similar. The most effective sorbent with Saar and Utah coals was the RWK hydrated lime injected through the outer tertiary ports for both burners. For the Weiher SM burner, limestone injection through the tertiary ports achieved SO_2 reduction comparable to the hydrated lime. The injection location of the limestone sorbent had some effect on capture achieved with the Weiher burner, but essentially no effect with the optimized burner. Tertiary air velocity, varied using inserts during tests with the optimized burner, did not measurably affect capture. Coal type, or composition, had little effect on SO_2 capture by sorbent injection for the optimum and Weiher burners. Operating variables that had negligible effect on SO_2 reduction with sorbent injection for both burners included degree of staging and firing rate.

During the Weiher SM burner tests, NO_x emissions increased when limestone was injected into the mill with the Saar coal. The increase in NO_x appeared to be proportional to the sorbent injection rate, ranging from 5 to 15 percent over the baseline NO_x emissions as sorbent flow increased. This phenomena occurred with the U.S. coals also but to a much lesser degree. No measurable change in NO_x emissions occurred during the sorbent injection tests with the optimized SM burner.

8.0 REFERENCES

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APPENDIX A

QUALITY ASSURANCE

A.0 OBJECTIVES

The collection and analysis of quality data are keys to the success of this program. Procedures outlined in the Quality Assurance Project Plan, submitted prior to beginning actual testing, were followed to ensure data quality. Specific Quality Assurance (QA) program objectives are outlined in Table A-1. These objectives were based on the program requirement and the precision and accuracy levels achievable by the selected measurement methods. Table A-2 lists the sampling procedures for each measurement. The procedures are standard EPA, ASTM, or other recognized methods. The following QA procedures utilized during this program are divided into daily routine and system verification checks:

Daily Routine

- Air Flow Distribution
- Air Preheat and Combustor Wall Temperatures
- Gas Phase Species - Continuous Monitoring
- Pretest Oil Check
- Coal Size Distribution
- Time Limitation of Valid Data

System Verification

- Venturi Flowmeter Calibrations
- Instrument Performance Tests

The incorporation of the QA procedures into the test plan ensured the documentation and collection of quality data resulting in more accurate results and conclusions with a greater degree of confidence.

TABLE A-1. PROGRAM OBJECTIVES FOR MEASUREMENT PRECISION, ACCURACY AND COMPLETENESS

Parameters	Measurement Methods	Reference	Precision: Relative Standard Deviation (%)	Accuracy (%)
Burner Settings	Direct Inspection		10	10
Air Distribution	Calibrated Venturi Flowmeter		4	5
Air Flow Rate and Distribution	Thermocouples		5	5
Fuel Flow Rate	Weigh Belt Feeder		4	10
Combustor Wall Temperature	Thermocouples		5	5
NO/NO_x	Continuous Monitor Chemiluminescence	EPA Performance Specification 2	2	20
CO	Continuous Monitor NDIR		2	20
CO_2	Continuous Monitor NDIR	EPA Performance Specification 3	2	20
SO_2	Continuous Monitor UV	EPA Performance Specification 2	2	20
O_2	Continuous Monitor (Paramagnetic)	EPA Performance Specification 3	2	20
SO_3	Controlled Condensation	Process Meas Proc EPA 68-02-2165, 2/77	20	20
Particulate Mass Loading	In-situ Filter Probe		12	20
Solid Composition	Ultimate and Proximate Analyses (ASTM)	ASTM D3176 ASTM D3172	5	5
Fuel Size Distribution	ASTM Method	ASTM D197	10	10
Flame Characteristics	Color Video and Direct Inspection		Qualitative	Qualitative
Sorbent Feed Rate	Volumetric Feeder		10	10
Windbox Pressure	Magnahelic-Bourdon tube		10	10

TABLE A-2. SAMPLING PROCEDURES

Parameters	Measurement Methods	Sampling Location Selection Criteria	Sampling Procedure	Sampling Frequency	Reference
Burner Settings	Direct Inspection	Burners	Direct Inspection	Every Test Condition	
Air Distribution	Calibrated Venturi Flowmeter	Air Inlet Ducts		Every Test Condition	
Air Preheat Temperature	Thermocouples	Burner		Every Test Condition	
Fuel Flow Rate	Weigh Belt Feeder	Upstream of Pulverizer	Continuous Direct Weight	Every Test Condition	
Combustor Wall Temperature	Thermocouples	Selected Locations in Furnace		Every Test Condition	
NO/NO_x	Continuous Monitor Chemiluminescence	Modified EPA Performance Specifications for Continuous Monitors	Extractive (See Text)	Continuous	Fed Register Vol 44 No 197 Oct 10, 1979 pp 58602-58636
CO	Continuous Monitor NDIR				
CO_2	Continuous Monitor NDIR				
SO_2	Continuous Monitor UV				
O_2	Continuous Monitor Paramagnetic				
SO_3	Controlled Condensation	EPA Process Measurement Procedures		Selected Conditions	
Particulate Mass Loading	In-Situ Filter Probe	EPA Level 1 Solid Sampling Procedures	Extractive	Selected Conditions	Fed Register Vol 42 No 160 Aug 18, 1977 pp 41776-41782
Particulate Size Distribution	X-Ray Sedimentation				
Solid Composition	Ultimate and Proximate Analyses (ASTM D3176 and D3172)		Grab Sample	Daily	EPA 600/7-78-201 p 105
Fuel Size Distribution	ASTM Method	ASTM D197	Multipoint Grab Sample	Daily	ASTM D197
Flame Characteristics	Color Video and Direct Inspection	Furnace Sample Ports		Every Test Condition	

Table A-3 summarizes the precision and accuracy results of the system measurements as determined in accordance with the QAPP. For each of the measurements conducted, the results are within the precision and accuracy limits established. The oil check and NO_x precision of baseline conditions are two measurements that were not included in the QAPP. Both of these measurements indicate the overall precision of the complete measurement system including fuel and air flows, temperatures, and emission instrumentation. The oil check is discussed in Section A-1.4. The NO_x precision was determined from the repeated baseline points throughout the entire test series. This indicates constant conditions as determined by firing rate, air flow distributions, and emission measurements. The following sections discuss these procedures.

A.1 Daily Routine Procedures

Routine calibrations and checks were performed on a daily basis to ensure that test data would be accurate, representative, and reproducible. Daily calibrations included air flow indication and flue gas analyzers. Other daily checks included verification of thermocouple operation, system oxygen balance while firing oil igniter, pulverized coal size distribution, and time-averaged valid data.

A.1.1 Air Flow Distribution

The distribution of combustion air between the burner passages was determined by direct measurement of the air flow rate to each passage using 18-inch venturi flowmeters. Each venturi was calibrated immediately prior to each test series using a standard pilot tube. During the tests, the pressure drop of the air through each venturi was continuously monitored using low pressure electronic transducers. Each transducer was calibrated manually prior to and immediately after testing each day at pressure differentials of 0-in and approximately 3-in. H_2O. The specific values of these calibrations were logged daily as shown in Table A-4 for a representative day. The response from the transducers was calibrated within their linear range such that 1.0 mV response = 2.0 in H_2O pressure differential. From these

TABLE A-3 SUMMARY OF PRECISION AND ACCURACY RESULTS

MEASUREMENT	PRECISION (%)		ACCURACY (%)	
	ACTUAL	GOAL	ACTUAL	GOAL
Air Distribution	2.30	4	2.56	10
Fuel Flowrates	3.27	4	5.44	10
Fuel Size Distribution	2.9	10	5.61	10
Oil Check	1.7	--	5.86	10
NO_x (Repeatability at baseline conditions)	4.41	--	---	--
O_2	0.25	2	7.78	20
CO_2	1.16	2	1.39	20
CO	1.34	2	---	--
NO_x	0.6	2	3.39	20
SO_2	0.74	2	14.49	20

TABLE A-4. TYPICAL VENTURI FLOWMETER PRESSURE TRANSDUCER CALIBRATIONS

TRANSDUCER CALIBRATIONS

DATE: 2-6-84 FACILITY: LWS PROJECT: Steinmüller

	0638		0644		17:01		17:02									
TRANSDUCER/ VENTURI	ZERO		SPAN		ZERO		SPAN		ZERO		SPAN		ZERO		SPAN	
	ΔP	MV	ΔP	MV	ΔP	MV	ΔP	MV	ΔP	MV	ΔP	MV	ΔP	MV	ΔP	MV
1	0.0	-.001	8.6	0.108 4.308	0.0	-.002	4.6	0.092 2.208								
2		-.001		0.107 4.307		.006		0085 2.215								
3		-.001		0.003 4.303		.009		0.081 2.219								
4		.002		0.007 4.307		-0.0		0.091 2.209								
5		.001		0.006 4.306		.013		0.082 2.215								
6		.003		0.006 4.306		.020		0.259 2.559								
7		-.003		0.008 4.308		.006		0.085 2.215								
8		-.002		0.008 4.309		-.003		0.094 2.266								
9	0.0	.008	8.6	0.001 4.301	0.0	.015	4.6	0.085 2.215								
10																

calibrations, the percent drift of the transducer could be calculated to assure the precision of the air flow measurements. Table A-5 summarizes the calibration drift of the transducers for the second phase of testing. The zero drift was 0.69 percent and the calibration drift was 2.56 percent.

A.1.2 Air Preheat and Combustor Wall Temperatures

Type K (Chromel/Alumel) thermocouples were used to monitor the combustion air and furnace wall temperatures. ASTM Standard E230-77 specifies that the standard limit of error for Type K commercial thermocouples is ± 2°C, or ± 0.75 percent of the temperature being measured, between 0° and 1250°C. To assure that the thermocouples were functioning during testing, a continuous output of the temperatures was displayed on the computer data acquisition printout. In case of thermocouple malfunction, the damaged TC was immediately replaced if possible. If, due to location restrictions, it was not practical to replace the TC while testing, it was replaced prior to the next day of testing.

A.1.3 Gas Phase Species

The exnaust gas phase species composition was measured using the LWS laboratory sampling system as outlined in Figure A-1. Flue gas was sampled immediately upstream of the LWS system SO_x and particulate scrubber ensuring that the flue gas sample was representative of the furnace effluent. A single sample probe which draws from the center of the duct was used. All materials in contact with the sample gas are limited to glass, stainless steel, Teflon, and a small amount of Kel-F (valve seals) since these materials have been demonstrated as essentially nonreactive to the gases measured over the temperature range involved in this system.

This system is generally satisfactory for most tests, but may result in SO_2 loss under conditions where SO_2 sorbents, such as limestone, are present. Therefore, an independent SO_2 sample system, described in Section 3, was utilized. the critical temperatures of the SO_2 sample system were maintained and recorded in a daily log. Table A-6 shows an example of the daily test

TABLE A-5 CALIBRATION DRIFT DETERMINATION OF PRESSURE TRANSDUCERS FOR AIR FLOW RATE CALCULATION

Initial Zero Cal. (MV)	Zero Error (MV)	Initial Calibration (MV)	Cal. Error (MV)	Confidence Interval Zero (MV)	Zero Drift (%)	Confidence Interval Zero (MV)	Calibration Drift (1%)
0.005 ± 0.013	0.012 ± 0.019	2.170 [a]	0.0476 = 0.050	0.0029	0.69	0.0079	2.56

[a] Reference ΔP using inclined manometer.

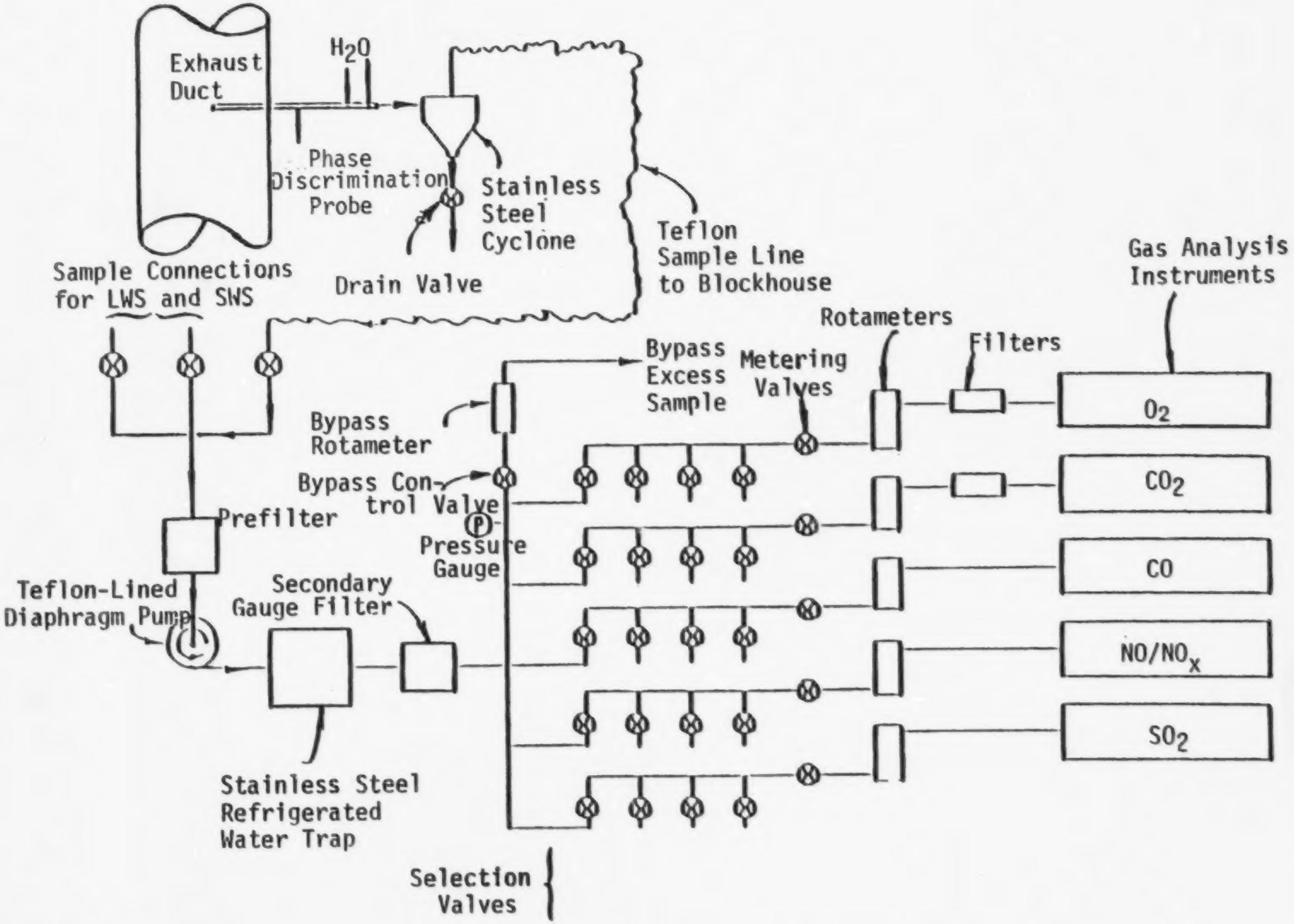

Exhaust Duct
H_2O
Phase Discrimination Probe
Stainless Steel Cyclone
Drain Valve
Teflon Sample Line to Blockhouse
Sample Connections for LWS and SWS
Gas Analysis Instruments
Rotameters
Filters
Metering Valves
Bypass Excess Sample
Bypass Rotameter
Bypass Control Valve
P
Pressure Gauge
Prefilter
Teflon-Lined Diaphragm Pump
Secondary Gauge Filter
Stainless Steel Refrigerated Water Trap
Selection Valves
O_2
CO_2
CO
NO/NO_x
SO_2

Figure A-1. LWS sample train.

TABLE A-6. SO_2 SAMPLE SYSTEM DAILY LOG FOR 2-28-84

Time	Probe Exit Temp. (°F)	Filter Oven Temperature (°F)	Cell Temperature (°C)	Pump Pressure (psi)	Sample Flow (cfh)	Perma-Pure Dry Air Flow (cfh)
1215	460	274	135	3	3.0	35
1300	358	270	135	3	3.0	35
1345	432	279	135	3	3.0	35
1500	428	252	135	3	3.0	35
1550	480	268	135	3	5.0	35
1700	374	247	135	3	5.0	35

log of temperatures and sample flows. This log represents instantaneous readings of the listed parameters checked every 45 minutes. The filter may also introduce an error in SO_2 concentration measured during sorbent injection due to agglomeration of particles on the filter, thus creating a scrubbing effect independent of the injection parameters. Therefore, this filter was changed at least after every two tests of sorbent injection had been completed or as necessary to maintain a clean filter. During sorbent testing, baseline test points (with no sorbent) were taken immediately preceding sorbent injection. After the sorbent test was completed, the system was allowed to return to baseline conditions before continuing with sorbent injection. Therefore, the relative SO_2 concentrations of the preceding and post test baseline should remain constant, therefore assuring that no measured SO_2 loss was occurring during sorbent injection because of any scrubbing effects of the sample system.

Table A-7 lists the continuous gas analyzers used during these tests. To ensure accuracy, the instruments are operated according to EPA Performance Standards 2 and 3. Each instrument was calibrated with three certified gases; a zero gas and two span gases, at approximately 50 and 90 percent of scale. To increase accuracy and precision, the instruments were calibrated approximately every two hours during the test day. The instrument calibrations included electronically calibrating the instrument response to the data logger and the strip chart recorder, simultaneously. This ensured that the instrument, computer printout, and the strip chart were in agreement. The calibrations were documented in a calibration log, such as the example shown as Table A-8, as well as the computer printout and strip chart. This log provided data to evaluate the calibration drift of each instrument for each day of testing. Generally, if the calibration drift exceeded 4 percent during a calibration interval, the valid data obtained during that period was corrected for drift.

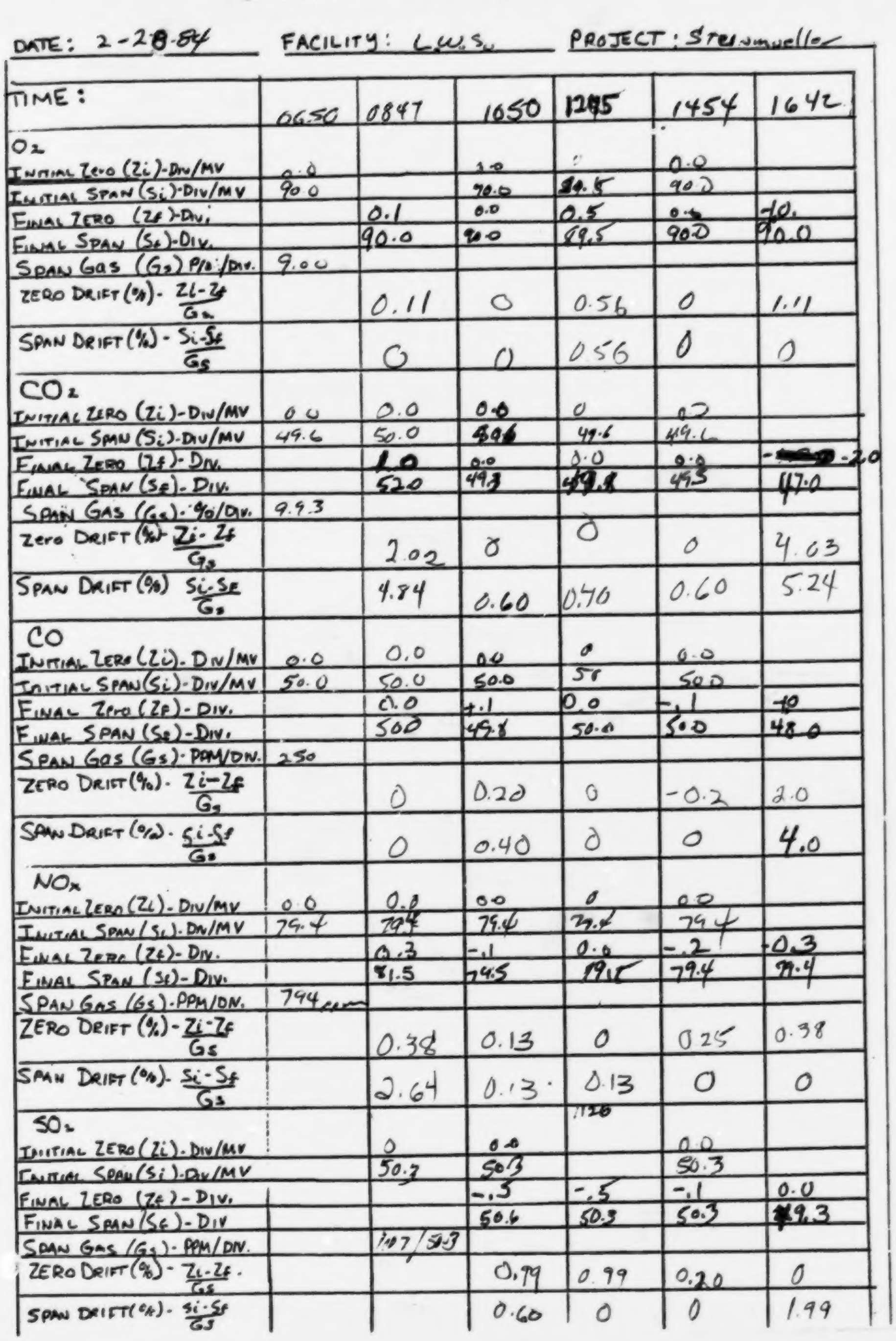
A.1.4 Pretest Oil Check and Coal Feed Rate Determination

A pretest oil check was completed daily, prior to switching the system to coal. The oil check is used to warm up the system and as a QA check on

TABLE A-7 CONTINUOUS GAS ANALYZERS

Gas Measured	Type of Instrument	Manufacturer	Model No.	Range
NO, NO_x	Chemiluminescent	Thermo Electron Corp. (TECO)	10 AR	1000 ppm
CO	Nondispersive Infrared (NDIR)	Anarad, Inc.	AR500R	500 ppm/2500 ppm
CO_2	Nondispersive Infrared (NDIR)	Anarad, Inc.	AR500R	25 percent
O_2	Paramagnetic Phase I Phase II	Taylor Servomex Beckman	Type OA 272 755	10/25 percent
SO_2	UV Absorption	DuPont	400	5000 ppm

TABLE A-8. TYPICAL DAILY INSTRUMENT CALIBRATION LOG



INSTRUMENT CALIBRATION LOG

DATE: 2-28-84 FACILITY: L.W.S. PROJECT: Steinmueller

TIME:	0650	0847	1050	1295	1454	1642
O_2						
Initial Zero (Z_i)-Div/MV	0.0		1.0	0	0.0	
Initial Span (S_i)-Div/MV	90.0		90.0	89.5	90.0	
Final Zero (Z_f)-Div.		0.1	0.0	0.5	0.0	-1.0
Final Span (S_f)-Div.		90.0	90.0	89.5	90.0	90.0
Span Gas (G_s) P/O/Div.	9.00					
Zero Drift (%) - $\frac{Z_i - Z_f}{G_s}$		0.11	0	0.56	0	1.11
Span Drift (%) - $\frac{S_i - S_f}{G_s}$		0	0	0.56	0	0
CO_2						
Initial Zero (Z_i)-Div/MV	0.0	0.0	0.0	0	0.0	
Initial Span (S_i)-Div/MV	49.6	50.0	49.6	49.6	49.6	
Final Zero (Z_f)-Div.		1.0	0.0	0.0	0.0	-2.0
Final Span (S_f)-Div.		52.0	49.3	49.8	49.3	47.0
Span Gas (G_s)-%/Div.	9.93					
Zero Drift (%) - $\frac{Z_i - Z_f}{G_s}$		2.02	0	0	0	4.03
Span Drift (%) $\frac{S_i - S_f}{G_s}$		4.84	0.60	0.40	0.60	5.24
CO						
Initial Zero (Z_i)-Div/MV	0.0	0.0	0.0	0	0.0	
Initial Span (S_i)-Div/MV	50.0	50.0	50.0	50	50.0	
Final Zero (Z_f)-Div.		0.0	+.1	0.0	-.1	-1.0
Final Span (S_f)-Div.		50.0	49.8	50.0	50.0	48.0
Span Gas (G_s)-PPM/Div.	250					
Zero Drift (%) - $\frac{Z_i - Z_f}{G_s}$		0	0.20	0	-0.2	2.0
Span Drift (%) - $\frac{S_i - S_f}{G_s}$		0	0.40	0	0	4.0
NO_x						
Initial Zero (Z_i)-Div/MV	0.0	0.0	0.0	0	0.0	
Initial Span (S_i)-Div/MV	79.4	79.4	79.4	79.4	79.4	
Final Zero (Z_f)-Div.		0.3	-.1	0.0	-.2	-0.3
Final Span (S_f)-Div.		81.5	79.5	79.5	79.4	79.4
Span Gas (G_s)-PPM/Div.	794 ppm					
Zero Drift (%) - $\frac{Z_i - Z_f}{G_s}$		0.38	0.13	0	0.25	0.38
Span Drift (%) - $\frac{S_i - S_f}{G_s}$		2.64	0.13	0.13	0	0
SO_2				1120		
Initial Zero (Z_i)-Div/MV		0	0.0		0.0	
Initial Span (S_i)-Div/MV		50.3	50.3		50.3	
Final Zero (Z_f)-Div.			-.3	-.5	-.1	0.0
Final Span (S_f)-Div			50.6	50.3	50.3	49.3
Span Gas (G_s)-PPM/Div.		107/50.3				
Zero Drift (%) - $\frac{Z_i - Z_f}{G_s}$			0.79	0.99	0.20	0
Span Drift (%) - $\frac{S_i - S_f}{G_s}$			0.60	0	0	1.99

the overall LWS process system. The oil check is a ratio between the calculated and measured load. The calculated load is a theoretical determination based on the heating value of the fuel oil and the measured oil flow rate. It is independent of the air flow system. The measured load is a function of the O_2 concentration measured in the exhaust gases and the air and fuel flow rates. The resultant ratio indicates the overall accuracy of the measurement system: transducers, continuous monitoring instruments, temperatures, and fuel flow rate. The difference between the calculated and measured load had to be less than 10 percent in order to proceed with testing.

During the initial shakedown days prior to Phase II testing, it was difficult to obtain an oil check. This was primarily due to the inability to obtain efficient combustion of oil with the SM-II burner and the initial LWS facility oil nozzle. Iterative trials and modifications to the oil ignition system determined two conditions necessary for efficient combustion to obtain satisfactory oil checks:

1) A large capacity nozzle yielding an oil flow corresponding to approximately 60 x 10^6 Btu/hr was required.
2) The SM-II burner core air was opened for maximum flow.

With these conditions, it was possible to complete oil checks without smoke and with reasonable CO emissions.

Figure A-2 shows the daily plot of the oil checks obtained throughout the Phase II test series. This plot shows the relative trend of the overall system and a determination of the system precision. The oil check remained in the 5-7% range consistently, indicating that the overall system accuracy was generally constant. The relative accuracy of the system as determined from the oil check was 5.86%. The repetition of a measurement indicates the precision of a specific measurement. The precision of the oil check over the test period was ± 1.7%.

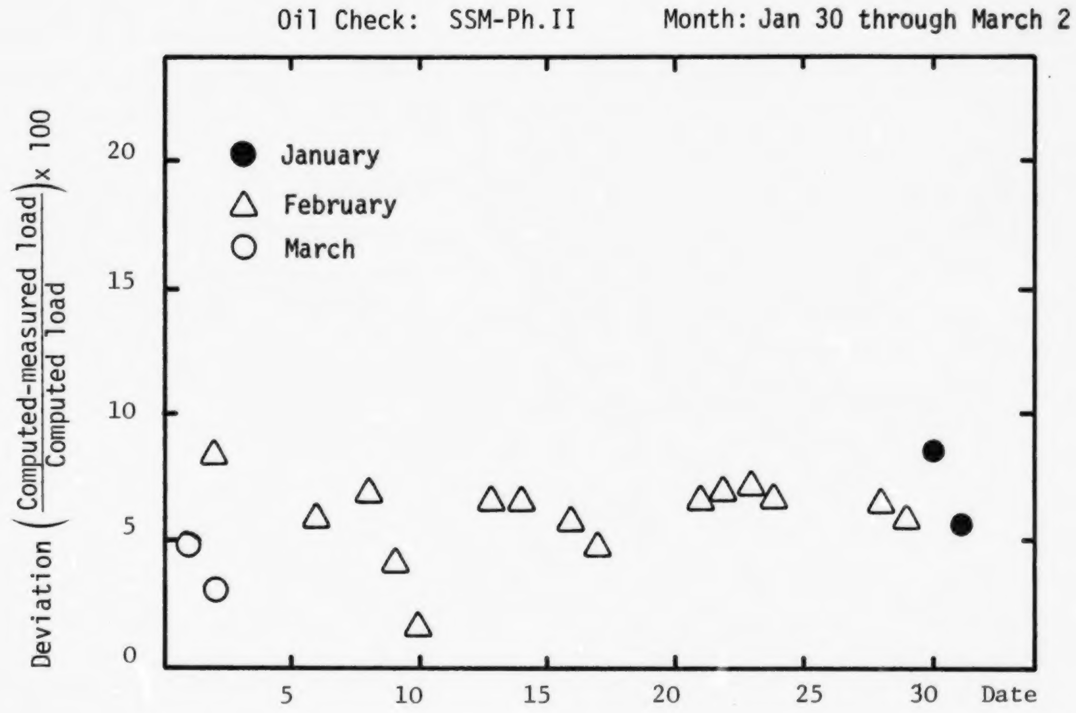


Figure A-2. Phase II oil check log

The coal input feed rate is calculated using an oxygen balance and also monitored continuously with a weigh belt feeder which controls the mass flow of coal into the pulverizer. The oil check oxygen balance verifies that the calculation of the coal firing rate is accurate. The weigh belt feeder also serves to confirm the calculation. The load cell of the feeder has an accuracy of ± 0.1 percent. However, it is necessary to calibrate the load cell dynamically and adjust the electronic set points according to the manufacturer's specification. The feeder was calibrated prior to the test series and during the tests as necessary after maintenance or repair.

A.1.5 Fuel Size Distribution

The coal fineness affects the combustion performance of the burner; therefore, it was necessary to determine the coal fineness daily. The coal sample was drawn isokinetically according to the procedures as outlined in ASTM Method D197 and the ASME Performance Test Code for Coal Pulverizers. The coal sample probe is shown in Figure A-3. An isokinetic sample is drawn by a vertical and horizontal traverse of the coal pipe at a sample location downstream of the pulverizer. A sample was taken daily for each coal type and firing rate. The recovery rate as specified by the method must be 100% ± 10%. After each sample, the recovery rate was calculated. Table A-9 shows the summary of the recovery rate obtained during the Phase II tests. If the recovery rate was not within the limits, another sample was taken if conditions allowed. After verifying a recovery rate of 100 ± 10%, the sample was analyzed for size distribution.

The main concern for burner performance was to ensure that the coal size distribution resulted in at least 70 percent of the coal particles passing through 200 mesh (75 microns). The sieves were standard ASTM sieves used with a commercial air sieve. The sieve was calibrated using the National Bureau of Standards Reference Material (SRM) 1004. SRM 1004 is a set of calibrated glass beads with specific cumulative size distribution determined by microscopic measurement. The calibration results are summarized below. The relative accuracy of the calibration is 5.61 percent which is within the program limits of 10 percent.

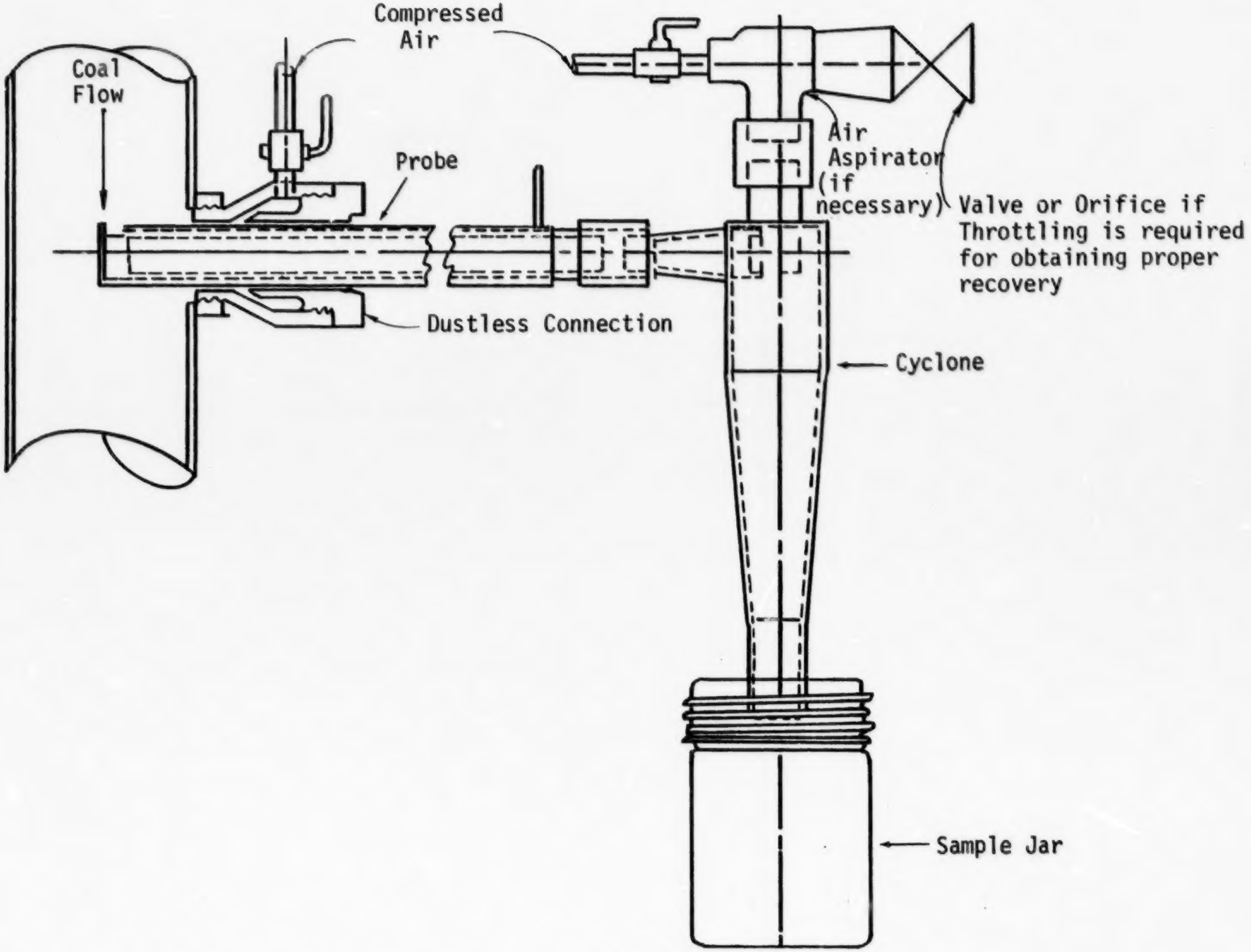

Compressed Air
Coal Flow
Probe
Air Aspirator (if necessary)
Valve or Orifice if Throttling is required for obtaining proper recovery
Dustless Connection
Cyclone
Sample Jar

Figure A-3. Pulverized coal sampling system.

TABLE A-9 COAL FINENESS/RECOVERY RATE SUMMARY

			Burner Flow Rate						Sample Flow Rate					
Date	Time	Sample No.	Ktron Load (lbs/hr)	Calculated Load (x 10^6 Btu/hr)	Calculated Coal Flow (lbs/hr)	Coal Flow (lbs/min)	Coal Pipe Area (in^2)	Burner Collection Rate* (lbs/min/in^2)	Coal Collected (gms)	Sample Time (min)	Sample Coal Flow Rate (lbs/min)	Nozzle Area (in^2)	Sample Collection Rate* (lbs/min/in^2)	Recovery Rate (%)
2/09/84	1300-1308	1-A	8900	100.0	8499	141.65	148.49	0.9539	245.64	2.0	0.2705	0.305	.8870	93.0
2/10/84	1118-1125	2-A	7800	106.0	7857	130.95	148.49	0.8819	272.48	2.0	0.3000	0.305	0.9836	112.0
2/10/84	1158-1205	2-B	7700	107.0	7931	132.18	148.49	0.8902	259.34	2.0	0.2856	0.305	0.9364	105.2
2/13/84	1110-1116	3-A	8300	102.0	7997	133.28	148.49	0.8976	307.63	2.0	0.3388	0.305	1.1108	123.8
2/13/84	1144-1155	3-B	8300	106.9	8381	139.68	148.49	0.9412	309.82	2.10	0.3152	0.305	1.033	100.8
2/14/84	1210-1225	4-A	8000	107.3	8412	140.2	148.49	0.9447	251.44	2.0	0.2772	0.305	0.9087	96.2
2/16/84	1207-1215	5-A	8300	101.0	7918	131.97	148.49	0.8888	254.0	2.0	0.2797	0.305	0.9170	103.0
2/17/84	1203-1208	6-A	8300	104.0	8154	135.9	148.49	0.9152	277.99	2.0	0.3062	0.305	1.004	109.7
2/21/84	1202-1210	7-A	8000	102.4	8028	133.8	148.49	0.9015	242.9	2.0	0.2675	0.305	0.8770	97.3
2/22/84	1535-1540	8-A	8700	98.0	7683	128.05	148.49	0.8623	205.2	2.0	0.2260	0.305	0.7410	85.9
2/24/84	1130-1138	9-A	8500	100.0	7840	130.7	148.49	0.8800	305.47	2.0	0.3364	0.305	1.1030	125.3
2/24/84	1205-1210	9-B	8500	103.0	8075	134.6	148.49	0.9065	235.42	2.0	0.2593	0.305	0.8502	93.8
3/01/84		10-1	8300	100.0	7965	132.75	148.49	0.8945	245.13	2.0	0.2700	0.305	0.8851	98.95
3/02/84	1020-1025	11-1	7900	102.0	7561	126.01	148.49	0.8491	239.05	2.0	0.2634	0.305	0.8637	101.7

*Note: Collection rate = Flow [lb/min]/Area [in^2]

Sieve No.	Sieve Effective Opening (Microns)	Weight % Finer < (EER Sieve)	Weight % Finer < NBS-SRM	Relative Accuracy (%)
200	75	46.25	49.0	5.61

A.1.6 Valid Data Acquisition

The outputs of all continuous monitoring instrumentation (flow rates, temperatures, and emissions) are converted to electrical signals, digitized, and supplied to a Hewlett-Packard computer. The computer processes these data and provides a real-time indication of input and output parameters. As a QA procedure, during a given test condition, valid data points are recorded which summarize that test.

Experience with the operation of the data acquisition has shown that the accuracy of the calculated results can be affected by two abnormalities: random electrical noise and time varying input parameters. The LWS system includes several small and large electrical motors as well as solenoid valves, switches and other sources of electrical disturbances. If a noise pulse in any of the inputs to the data acquisition system occurs during the period when that input is being sampled, an erroneous signal will be recorded. Most of the inputs to the data acquisition system remain essentially constant once the controls have been set. However, the gas phase concentrations vary substantially after the controls are set. Some of these variations are due to response time (seeking equilibrium) and some are due to random variations in the coal-feed system and/or the combustion process. The data acquisition system samples the inputs sequentially. Thus, some of the gas concentrations may be sampled at the "peaks" and some may be sampled at the "valleys," resulting in considerable data scatter.

To provide consistently accurate data, the data acquisition system is operated in two modes. In the "auto-data mode" all data including the gas concentrations are input directly. The system is operated continuously, recording an auto-data point approximately every minute. This provides a real time indication of system performance subject to the potential errors discussed above. During the auto-data mode the strip chart indications of gas concentrations are monitored. When the traces reach equilibrium, the time and corresponding auto-data point number are recorded. At the end of a 15-minute (or longer) period where all test conditions remained essentially constant, the time and corresponding auto-data point number are again recorded. The strip chart traces are then visually averaged and manually input to the computer along with any nonelectrical data and comments. The auto-data points corresponding to the test period are then scanned and a representative data point is selected. The valid datum point is calculated from the averaged strip chart values and the selected auto-datum point. The valid data points are the final test output.

A.2 System Verification Procedures

During this test program, system verification procedures that were performed included venturi flowmeter calibrations and instrument performance tests. The accuracy and precision of both air flow and the concentrations of exhaust gas components are essential to achieving quality data.

A.2.1 Venturi Flowmeter Calibration and Leak Checks

Calibrations of the venturi flowmeter were performed prior to the start of testing. The relationship between the air flow rate and pressure drop across the venturi can be expressed as:

$$Q = K\ (\Delta P/T)^{1/2} \qquad \text{(A-1)}$$

where: Q = mass flowrate through the venturi (scfm)

P = pressure drop across the venturi (in H_2O)

T = absolute air temperature (^{o}R)

K = calibration constant

Calibrations were conducted for each venturi meter over a range of air flow rates, with the data reduced to the form of equation (A-1). These calibrations were incorporated into the data acquisition program used for this program. Records of the calibrations are maintained at EER.

The air flow rates measured by the venturis in the LWS system are remotely monitored. Each venturi is equipped with pressure taps located between the inlet and throat and thermocouples located at the inlet, with the pneumatic tubing and thermocouple lead wire run into the LWS control room. Because of the high humidity and high temperature environment during testing, leak checks of the pneumatic tubing from the venturi to pressure transducers in the control room are conducted periodically during the test program. Table A-10 illustrates a typical leak check test performed during the Phase II tests. If a leak was discovered during the test, it was immediately repaired.

A.2.2 Instrument Performance Tests

The LWS continuous monitoring system is operated according to EPA Specifications 2 and 3. These specifications include instrument performance test guidelines. As part of the QA plan for this test series, an abbreviated instrument performance test was conducted. Table A-11 summarizes the results.

The relative accuracy was determined by comparing the instrument values to values obtained using EPA Reference Methods. There is currently no performance specification for the CO monitor or standard reference method for CO determination. Therefore, relative accuracy for CO could not be determined, but the remaining tests were conducted in accordance with the guidelines for the other analyzers. The results show that the relative accuracy for all four instruments are within specifications. The linearity (calibration error) was also within specifications except for the high level CO. The high range of the CO is extremely sensitive to adjustment which probably accounts for this difference. Also, the CO_2 calibration drift is higher than the specifications. This was probably due to inherent problems

TABLE A-10. TYPICAL VENTURI/TRANSDUCER LEAK CHECK

LWS VENTURI/TRANSDUCER LEAK CHECK

DATE 1-19-84 PROJECT 8482-22 LEAK CHECK COMPLETED BY Roy N.

TRANSDUCER #	HIGH SIDE					LOW SIDE					PROBLEM	REPAIR
	$T_{INITIAL}$	T_{FINAL}	ΔP_{PT} ("H_2O)	ΔP_{CR} ("H_2O)	LEAKAGE RATE (%)	$T_{INITIAL}$	T_{FINAL}	ΔP_{PT} ("H_2O)	ΔP_{CR} ("H_2O)	LEAKAGE RATE (%)		
1	—	—	—	—	—	—	—	—	—	—	—	—
2	8:19	8:23	6.2	6.2	0	8:25	8:29	4.8	4.8	0	—	—
3	12:10	12:13	3.8	3.8	0	12:05	12:08	9.6	9.6	0	—	—
4	11:35	11:36	5.1	0	100%	11:41	11:50	8.8	8.8	0	HAd Line cut in half	Yes we Repaired
5	8:42	8:46	4.4	4.4	0	8:48	8:52	4.4	4.4	0	—	—
6	10:47	10:51	9.2	9.2	0	10:55	10:59	3.4	3.4	0	—	—
7	12:54	12:57	4.8	4.8	0	12:49	12:52	7.4	7.4	0	—	—
8	12:41	12:44	4.0	4.0	0	12:35	12:39	8.0	8.0	0	—	—
9	12:25	12:28	4.4	4.4	0	12:21	12:24	13.6	13.6	0	—	—
4	1-23-84 8:20	8:24	5.6	5.6	0							

ΔP_{PT} = ΔP @ Pressure tap

ΔP_{CR} - ΔP in Control room

COMMENTS:

TABLE A-11. INSTRUMENT PERFORMANCE TESTS SUMMARY

Instrument	Relative Accuracy[a]		Instrument Drift Test				Calibration Error			
			Zero		Calibration		Mid Level		High Level	
	Actual (%)	EPA Specification (%)	Actual (%)	EPA Specification (%)	Actual (%)	EPA Specification (%)	Actual (%)	EPA Specification (%)	Actual (%)	EPA Specification (%)
O_2	7.78	≤20	0.92	≤2.0	0.35	≤0.4	0.45	≤5	3.01	≤5
CO_2	1.39	≤20	1.43	≤2.0	4.08	≤0.4	0.996	≤5	1.292	≤5
SO_2	14.49 13.73[b]	≤20 ≤20	1.38	≤2.0	1.63	≤2.0	0	≤5	1.75	≤5
NO, NO_x	3.39 3.17[b]	≤20 ≤20	0.02	≤2.0	0.86	≤2.0	1.55	≤5	2.30	≤5
CO	---	---	2.33	---	2.39	---	0.912	---	5.03	---

Notes:

a) Relative accuracy based on the following standard methods:

O_2 and CO_2 - EPA Method 3 (Orsat)
NO_x - EPA Method 7
SO_2 - EPA Method 6

b) Results calculated based on $lb/10^6$ Btu with drift in NDIR instruments due to temperature fluctuations. As the control room and instruments reached a constant temperature (usually after ~2 hours), the drift decreased significantly. The effects of these calibration errors were minimized with frequent calibrations during testing.

APPENDIX B

QUALITY ASSURANCE
CALCULATIONS AND DATA

B.0 QUALITY ASSURANCE CALCULATIONS AND DATA

This appendix includes the following instrument performance data collected during this program:

1. Calibration Error Determination
    - a. O_2 - Beckman (Paramagnetic)
    - b. CO - Anarad (NDIR)
    - c. NO_x - TECO (Chemiluminescnet)
    - d. CO_2 - Anarad (NDIR)
    - e. SO_2 - DuPont (NDUV)

2. Calibration Gas Analysis
    - a. O_2 - EPA Method 3 (Orsat)
    - b. NO_x - EPA Method 7 (PDS)
    - c. CO_2 - EPA Method 3 (Orsat)
    - d. SO_2 - EPA Method 6

3. Relative Accuracy Determination
    - a. O_2 - Beckman
    - b. NO_x - TECO
    - c. CO_2 - Anarad
    - d. SO_2 - DuPont

4. Zero and Calibration Drift (2-hr.)
    - a. O_2 - Beckman
    - b. CO - Anarad
    - c. NO_x - TECO
    - d. CO_2 - Anarad
    - e. SO_2 - DuPont

Also included are the calculation sheets used in determining SO_2 analyzer performance. The specific sheets include determination of sample volume and moisture content, calibration gas analysis, and relative accuracy sample analyses.

The forms and equations referred to were extracted directly from the Federal Register, Vol. 44, No. 97 of Wednesday, October 10, 1979, pp. 58602-58636. This reference documents "Standards of Performance for New Stationary Sources; Continuous Monitoring Performance Specifications." The following equations from this document were used in the following worksheets:

Arithmetic Mean $$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \qquad \text{(B-1)}$$

Confidence Interval $$C.I._{95} = \frac{t_{.975}}{n\sqrt{n-1}} \sqrt{n\,(\Sigma\, x_i^2) - (\Sigma\, x_i)^2} \qquad \text{(B-2)}$$

Relative Accuracy $$R.A. = \frac{|\bar{x}| + |C.I._{95}|}{R.V.} \times 100 \qquad \text{(B-3)}$$

where: $\bar{x}$ = mean value
n = number of data points
Σx_i = algebraic sum of the individual measurements
$C.I._{95}$ = 95 percent confidence interval estimate of the average mean value.
$t_{.975}$ = Student's t distribution value for n data points

R.V. = reference value as defined in the above document.

SO$_2$ RELATIVE ACCURACY DETERMINATION

SUMMARY OF RESULTS

SO$_2$

8% moisture

	Date	Sampling Location	Run No.	Corrected Sample Volume: $V_{m_{std}}$ (ft³)	Titrant Volume: V_t (ml)	Total Solution Volume: V_{soln} (ml)	Aliquot Volume: Va (ml)	Titrant Normality: N	SO$_2$ Concentration C_{SO_2} (lbs/ft^3)	SO$_2$ Concentration C_{SO_2} (ppm)
1535-1556	1/30/84	LWS Exhaust	SO$_2$ #1	17.5127	7.66	500	2.0	0.010	7.66×10^{-5}	460.60 450 wet
1354-1426	1/31/84	LWS Exhaust	SO$_2$ #2	28.9896	13.45	500	2.0	0.010	8.1535×10^{-5} 11	544 490.23 470 wet
1525-1550	1/31/84	LWS Exhaust	SO$_2$ #3	26.4805	12.49	500	2.0	0.010	8.2861×10^{-5}	554 498.20 480 wet
1487-1507	2/16/84	LWS Exhaust	SO$_2$ #4	27.1222	12.96	500 V_{tb} = 0.04	2.0	0.010	8.41×10^{-5} 11	505.6 ppm dry

$$C_{SO_2} \; \text{lb/ft}^3 = \frac{(7.061\times10^{-5})\, N\, (V_t - V_{tb})\, (V_{soln}/V_a)}{V_{m_{std}}}$$

V_{tb} = 0.06

$$C_{SO_2} \; \text{ppm} = (C_{SO_2} \; \text{lb/ft}^3)\,(384.8 \; \text{ft}^3/\text{mole})\,(1 \; \text{mole}/64 \; \text{lbs})\; 10^6$$

O2 (BECKMAN) - CALIBRATION ERROR

Calibration Error Determination

Run no.	Calibration gas concentration %	Measurement system reading %	Arithmetic differences %	
	A	B	A-B	
			Mid	High
1	0	0.00%		
2	5.00	5.01	-0.01	
3	9.00	8.80		0.20
4	5.00	5.02	-0.02	
5	0	-0.01		
6	9.00	8.80		0.20
7	0	-0.01		
8	9.00	8.80		0.20
9	5.00	5.01	-0.01	
10	0	-0.01		
11	5.00	5.00		
12	9.00	9.00		0
13	5.00	5.02	-0.02	
14	9.00	8.80		0.20
15	0	-0.01		
Arithmetic Mean (Eq. B-1) =			0.0120	0.1600
Confidence Interval (Eq. B-2) =			0.0104	0.1110
Calibration Error (Eq. B-3) =			0.45	3.01

Mid-level: C = 5.0 %

High-level: D = 9.1 %

CO (ANARAD)
Calibration Error Determination

Run no.	Calibration gas concentration ppm	Measurement system reading ppm	Arithmetic differences ppm	
	A	B	A-B	
			Mid	High
1	0	0		
2	403	428		25
3	0	0		
4	250	249	1	
5	403	425		22
6	250	249	1	
7	0	0		
8	403	425		22
9	0	0		
10	250	248	2	
11	403	425		22
12	250	248	2	
13	403	424		21
14	250	248	2	
15	0	0		
Arithmetic Mean (Eq. B-1) =			1.60	22.40
Confidence Interval (Eq. B-2) =			0.6800	1.8828
Calibration Error (Eq. B-3) =			0.912	6.03

Mid-level: C = 250 ppm

High-level: D = 403 ppm

NO_x (TECO)
Calibration Error Determination

Run no.	Calibration gas concentration ppm	Measurement system reading ppm	Arithmetic differences ppm	
	A	B	A-B	
			Mid	High
1	0	0		
2	512	512	0	
3	794	809		15
4	0	0		
5	512	514	2	
6	794	808		14
7	512	512	0	
8	794	808		14
9	0	0		
10	512	510	2	
11	794	809		15
12	0	0		
13	794	798		4
14	512	522	10	
15	0	0		
		Arithmetic Mean (Eq. B-1) =	2.800	12.40
		Confidence Interval (Eq. B-2) =	5.1487	5.863
		Calibration Error (Eq. B-3) =	1.55	2.30

Mid-level: C = 512 ppm

High-level: D = 794 ppm

CO_2 (ANARAD) 2/8/84

After linearity adjustment

Calibration Error Determination

Run no.	Calibration gas concentration %	Measurement system reading %	Arithmetic differences %	
	A	B	A-B	
			Mid	High
1	0	0		
2	9.9	9.92	-0.02	
3	14.9	14.98		0.08
4	0	-.20		
5	9.9	9.95	0.05	
6	0	-.18		
7	14.9	15.05		0.15
8	9.9	9.96	0.06	
9	14.9	15.04		0.14
10	0	-0.02		
11	14.9	15.08		0.18
12	9.9	9.99	0.09	
13	14.9	15.07		0.17
14	9.9	9.99	0.09	
15	0	0.15		
Arithmetic Mean (Eq. B-1) =			0.0620	0.1440
Confidence Interval (Eq. B-2) =			0.0366	0.0486
Calibration Error (Eq. B-3) =			0.9961	1.292

Mid-level: C = 9.9 %

High-level: D = 14.9 %

Dupont SO2 Inst. SN/5357

2-3-84

OPERATOR
Jerry Johnson

Calibration Error Determination

Run no.	Calibration gas concentration ppm	Measurement system reading ppm	Arithmetic differences ppm	
	A	B	A-B	
			Mid	High
1	0	0		
2	398	398	0	
3	998	1014		16
4	0	0.0		
5	998	1012		14
6	398	398	0	
7	998	1016		18
8	0	0.0		
9	398	398	0	
10	0.0	0.0		
11	998	1012		14
12	398	398	0	
13	998	1012		14
14	0.0	0.0		
15	398	398	0	
Arithmetic Mean (Eq. B-1) =			0	15.20
Confidence Interval (Eq. B-2) =			0	2.2208
Calibration Error (Eq. B-3) =			0	1.75

Mid-level: C = 398 ppm

High-level: D = 998 ppm

O_2 CALIBRATION GAS ANALYSIS

Analysis of Calibration Gases[a]

Date 2/1/84 (Must be within 2 weeks prior to the operational test period)

Reference Method Used M3-Orsat

O_2

Sample Run	Mid-level[b] ppm	High-level[c] ppm
1		9.8
2		9.8
3		9.8
Average		9.8
Maximum % Deviation[d]		$\frac{9.9-9.8}{9.9}=1.01\%$

[a] Not necessary if the protocol in Citation 10.5 is used to prepare the gas cylinders.

[b] Average must be 45 to 55 percent of span value.

[c] Average must be 80 to 90 percent of span value.

[d] Must be $\leq \pm$ 10 percent of applicable average or 15 ppm, whichever is greater.

NOx CALIBRATION GAS Analysis

Analysis of Calibration Gases[a]

Date 12-20-83 (Must be within 2 weeks prior to the operational test period)

Reference Method Used METHOD 7

Sample Run	Mid-level[b] ppm	High-level[c] ppm
1		790
2		778
3		786
Average		784.7
Maximum % Deviation[d]		$\frac{794-785}{794} = 1.13\%$

[a] Not necessary if the protocol in Citation 10.5 is used to prepare the gas cylinders.

[b] Average must be 45 to 55 percent of span value.

[c] Average must be 80 to 90 percent of span value.

[d] Must be $\leq \pm$ 10 percent of applicable average or 15 ppm, whichever is greater.

Reported Value = 794 ppm

CO_2 CALIBRATION GAS ANALYSIS

Analysis of Calibration Gases[a]

Date 2/1/84 (Must be within 2 weeks prior to the operational test period)

Reference Method Used M3 - Orsat

Sample Run	Mid-level[b] ppm	High-level[c] ppm CO_2
1		14.8
2		14.8
3		14.8
Average		14 8 ✓
Maximum % Deviation[d]		$\frac{14.9-14.8}{14.9} = 0.67\%$

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[a] Not necessary if the protocol in Citation 10.5 is used to prepare the gas cylinders.

[b] Average must be 45 to 55 percent of span value.

[c] Average must be 80 to 90 percent of span value.

[d] Must be $\leq \pm$ 10 percent of applicable average or 15 ppm, whichever is greater.

- SO₂ CALIBRATION GAS Analysis

Analysis of Calibration Gases[a]

Date 1/31/84 (Must be within 2 weeks prior to the operational test period)

Reference Method Used M6

Sample Run	Mid-level[b] #1 ppm	High-level[c] ppm	Mid-level #2 ppm
1	951	2946	379
2	1009	2910	394
3	1034	2970	383
Average	997.9	2942	386
Maximum % Deviation[d]	880-997.9/880 = 13.4%	2981-2942/2981 = 1.31%	398-386/398 = 3.02%

[a] Not necessary if the protocol in Citation 10.5 is used to prepare the gas cylinders.

[b] Average must be 45 to 55 percent of span value.

[c] Average must be 80 to 90 percent of span value.

[d] Must be $\leq \pm$ 10 percent of applicable average or 15 ppm, whichever is greater.

SO_2 CALIBRATION GAS Analysis - cont.

Analysis of Calibration Gases[a]

Date 2/9/84 (Must be within 2 weeks prior to the operational test period)

Reference Method Used METHOD 6

Sample Run	Mid-level[b] #1 ppm	High-level[c] ppm
1	1014	
2	1035	
3	997	
Average	1015	
Maximum % Deviation[d]	$\frac{1015-997.9}{997.9} = 1.71\%$	

[a] Not necessary if the protocol in Citation 10.5 is used to prepare the gas cylinders.

[b] Average must be 45 to 55 percent of span value.

[c] Average must be 80 to 90 percent of span value.

[d] Must be $\leq \pm 10$ percent of applicable average or 15 ppm, whichever is greater.

1- Repeat analysis of Mid-level #1 from 1/31/84.
Final results < 10% deviation so took average of all 6 samples for new span value.

SPAN #1 = 1007 ppm

MAXIMUM Deviation = $\frac{1007-1034}{1007} = -2.68\%$

O_2 Relative accuracy determination

Run no.	Date and time	SO_2			NO_x[b]			CO_2 or O_2[a]		~~SO_2~~[a]			NO_x[a]		
		RM	M	Diff	RM	M	Diff	RM	M	RM	M	Diff	RM	M	Diff
		ppm[d]			ppm[d]			%[d]	%[d]	mass/GCV			mass/GCV		
1	2-7-84 1515							3.1	3.2			0.1			
2	2-7-84 1516							3.5	3.2			0.3			
3	2-7-84 1517							3.2	3.2			0.0			
4	2-7-84 1559							4.2	4.5			0.3			
5	2-7-84 1600							4.4	4.5			0.1			
6	2-7-84 1601							4.9	4.5			0.4			
7	2-7-84 1602							5.0	4.85			0.15			
8	2-7-84 1603							4.4	4.85			0.45			
9	2-7-84 1604							4.9	4.85			0.05			
10															
11															
12															
Average								4.1778				0.2150			
Confidence Interval												0.1100			
Accuracy[c]												7.78			

NOx Relative Accuracy Test

Run no.	Date and time	SO_2			NO_x[b]			CO_2 or O_2[a]		SO_2[a]			NO_x[a]		
		RM	M[d]	Diff	RM	M[d]	Diff	RM[d]	M[d]	RM	M	Diff	RM	M	Diff
		ppm[d]			ppm[d]			%[d]	%[d]	mass/GCV			mass/GCV		
1	2-7-84 1515-1517				304	290	14	3.27	3.2				0.4204	0.3995	0.02090
2	2-7-84 1559-1601				624	635	11	4.5	4.5				0.9274	0.9457	0.01630
3	2-7-84 1602-1604				626	635	9	4.77	4.85				0.9458	0.9642	0.01835
4	2-														
5															
6															
7															
8															
9															
10															
11															
12															
Average					518		11.33						0.7645		0.01852
Confidence Interval							6.252								0.00573
Accuracy[c]					3.39								3.172		

CO_2 Relative accuracy Determination

Run no.	Date and time	SO_2			NO_x^{b}			CO_2 or O_2^{a}		SO_2^{a}			NO_x^{a}		
		RM	M	Diff	RM	M	Diff	RM	M	RM	M	Diff	RM	M	Diff
		ppm^d			ppm^d			%^{d}	%^{d}	mass/GCV			mass/GCV		
1	2-7-84 1515							15.1	15.0			0.1			
2	1516							14.9	15.0			0.1			
3	1517							15.0	15.0			0			
4	1559							14.1	13.8			0.3			
5	1600							13.7	13.6			0.1			
6	1601							13.5	13.4			0.1			
7	1602							13.6	13.4			0.2			
8	1603							14.0	13.8			0.2			
9	1604							13.6	13.6			0			
10															
11															
12															
Average								14.1667				0.1222			
Confidence Interval												0.0747			
Accuracy^c										1.39					

SO_2 Relative Accuracy Determination

Run no.	Date and time	SO_2			NO_x[b]			CO_2 or O_2[a]		SO_2[a]			NO_x[a]		
		RM	M_d	Diff	RM	M_d	Diff	RM_d	M_d	RM	M	Diff	RM	M	Diff
		ppm			ppm			%	%	mass/GCV			mass/GCV		
1	1/30/84 1530-1558	461	wet dry 460/519	59				5.05	4.65	0.7087	0.7784	0.0697			
2	1/31/84 1359-1426	490	wet 490/541	51.0				4.85	4.70	0.7440	0.8139	0.06990			
3	1/31/84 1529-1558	498	wet 480/541	44				5.10	4.60	0.7684	0.8089	[illegible]			
4	2/16/84 1437-1507	dry 506	500	6				5.49	4.89	0.7954	0.7868	0.03857			
5															
6															
7															
8															
9															
10															
11															
12															
Average		483.1	533.1	51.33						0.7402		0.0602			
Confidence interval				18.646								0.0445			
Accuracy[c]		14.49								13.73					

BECKMAN O_2

Data set no.	Date	Time Begin	Time End	Zero Rdg Init. A	Zero Rdg Fin. B	Zero drift C=B-A	Hi-level Rdg Init. D	Hi-level Rdg Fin. E	Span drift F=E-D	Calib. drift G=F-C
1	2-29-84	920	1140	0	0	0	9.0	9.0	0	0
2	-1	1140	1333	0	0	0	9.0	9.0	0	0
3		1333	1542	0	0.10	0.1	9.0	8.95	0.05	0.05
4		1542	1835	0	0.01	0.01	9.0	8.98	0.02	0.01
5	3-1-84	913	1100	0	0	0	9.0	9.0	0	0
6		1100	1325	0	0.01	0.01	9.0	9.0	0	0.01
7		1325	1629	0	0.0	0	9.0	9.0	0	0
8	3	1629	1845	0	0.15	0.15	9.0	9.0	0	0.15
9	3-2-84	843	1132	0	0	0	9.0	9.0	0	0
10		1132	1340	0	0	0	9.0	9.0	0	0
11		1340	1645	0	0.15	0.15	9.0	8.9	0.1	0.05
12		1645	1818	0	0.10	0.10	9.0	8.8	0.2	0.10
13										
14										
15										
Arithmetic Mean (Eq. B-1)						0.0433				0.0308
Confidence Interval (Eq. B-2)						0.0396				0.0311
Zero Drift						0.92			Calibration drift	0.346

SPAN = 9.0%

Zero and Calibration Drift (2 hour)

CO ANARAD

Data set no.	Date	Time		Zero Rdg		Zero drift	Hi-level Rdg		Span drift	Calib. drift
		Begin	End	Init. A	Fin. B	C=B-A	Init. D	Fin. E	F=E-D	G=F-C
1	2-29-84	920	1140	0	0	0	250	250	0	0
2		1140	1333	0	0	0	250	250	0	0
3		1333	1542	0	10	10	250	270	20	10
4		1542	1835	0	10	10	250	260	10	0
5	3-1-84	913	1100	0	0	0	250	248	-2	-2
6		1100	1325	0	0	0	250	250	0	0
7		1325	1629	0	-3	-3	250	245	-5	-2
8		1629	1845	0	-10	-10	250	225	-25	-15
9	3-2-84	843	1132	0	0	0	250	249	-1	-1
10		1132	1340	0	0	0	250	250	0	0
11		1340	1643	0	0	0	250	250	0	0
12		1643	1818	0	0	0	250	245	-5	-5
13										
14										
15										
Arithmetic Mean (Eq. B-1)						3.00				2.9167
Confidence Interval (Eq. B-2)						2.830				3.0706
Zero Drift						2.33	Calibration drift			2.39

Zero and Calibration Drift (2 hour)

NO$_x$ TECO

Data set no.	Date	Time Begin	Time End	Zero Rdg Init. A	Zero Rdg Fin. B	Zero drift C=B-A	Hi-level Rdg Init. D	Hi-level Rdg Fin. E	Span drift F=E-D	Calib. drift G=F-C
1	7-29-84	920	1140	0	0	0	794	794	0	0
2		1140	1333	0	0	0	794	794	0	0
3		1333	1542	0	0	0	794	794	0	0
4		1542	1835	0	0	0	794	794	0	0
5	8-1-84	913	1100	0	0	0	794	814	10	10
6		1100	1325	0	0.3	0.3	794	775	-19	-19.3
7		1325	1629	0	0	0	794	800	6	6
8		1629	1845	0	0	0	794	794	0	0
9	8-2-84	843	1132	0	0	0	794	794	0	0
10		1132	1340	0	0	0	794	794	0	0
11		1340	1643	0	0	0	794	794	0	0
12		1843	1818	0	-0.5	-0.5	794	794	0	0.5
13										
14										
15										
Arithmetic Mean (Eq. B-1)						0.0667				2.9833
Confidence Interval (Eq. B-2)						0.1026				3.8407
Zero Drift						0.02	Calibration drift			0.859

Zero and Calibration Drift (2 hour)

CO₂ Anarad

Data set no.	Date	Time		Zero Rdg		Zero drift	Hi-level Rdg		Span drift	Calib. drift
		Begin	End	Init. A	Fin. B	C=B-A	Init. D	Fin. E	F=E-D	G=F-C
1	2-29-84	920	1140	0	0	0	9.92	9.84	-0.08	-0.08
2		1140	1333	0	0.10	0.10	9.92	9.92	0	0.10
3		1333	1542	0	0	0	9.92	10.2	0.28	0.28
4		1542	1835	0	0.2	0.2	9.92	10.2	0.28	0.26
5	3-1-84	913	1100	0	0.12	0.12	9.92	9.96	0.04	-0.08
6		1100	1325	0	0.16	0.16	9.92	9.88	-0.04	-0.20
7		1325	1629	0	-0.04	-0.04	9.92	9.90	-0.02	.02
8		1629	1845	0	-0.08	-0.08	9.92	9.60	-0.32	-0.24
9	3-2-84	843	1132	0	0.06	0.06	9.92	9.60	-0.32	-1.40
10		1132	1340	0	0.08	0.08	9.92	9.96	0.04	-0.04
11		1340	1643	0	-0.24	-0.24	9.92	9.20	0.76	-1.00
12		1643	1818	0	0.02	0.02	9.92	9.80	-0.12	-0.14
13										
14										
15										
Arithmetic Mean (Eq. B-1)						0.0933				0.2367
Confidence Interval (Eq. B-2)						0.0486				0.1687
Zero Drift						0.0143	Calibration drift			4.08

SPAN = 9.93

Zero and Calibration Drift (2 hour)

SO_2 DUPONT

Data set no.	Date	Time		Zero Rdg		Zero drift	Hi-level Rdg		Span drift	Calib. drift
				Init.	Fin.		Init.	Fin.		
		Begin	End	A	B	C=B-A	D	E	F=E-D	G=F-C
1	2-29-84	1140	1333	0	-10	-10	1006	1006	0	10
2		1333	1542	0	0	0	1006	1006	0	0
3		1542	1835	0	4	4	1006	1006	0	-4
4	3-1-84	913	1100	0	-2	-2	1006	1006	0	2
5		1100	1325	0	-20	-20	1006	998	-8	12
6		1325	1415	0	-0	0	1006	998	-8	-8
7		1415	1629	0	-20	-20	1006	1012	6	26
8		1629	1752	0	10	10	1006	990	-16	-26
9		1752	1845	0	12	12	1006	1008	2	-10
10	3-2-84	940	1132	0	-14	-14	1006	1012	6	20
11		1132	1245	0	-20	-20	1006	990	-16	4
12		1245	1445	0	-16	-16	1006	1016	10	26
13		1445	1716	0	0	0	1006	1010	4	4
14		1716	1818	0	4	4	1006	1010	4	0
15										
Arithmetic Mean (Eq. B-1)						9.4286				10.8571
Confidence Interval (Eq. B-2)						4.4929				5.4920
Zero Drift						1.38	Calibration drift			1.63

Span: 1006

Zero and Calibration Drift (2 hour)

SO_2 CALCULATIONS (RELATIVE ACCURACY)

	1535-1556 1-30-84 SO_2 #1	1354-1426 1-31-84 SO_2 #2	1528-1558 1-31-84 SO_2 #3	1437-1507 216-84 SO_2 #4		
Barometric Pressure: P_{bar} (In. Hg.)	30.0	30.0	30.0	30.0		
Static Pressure: P_g (in. H_2O)	–	–	–	–		
Area of Stack: A (ft²)	–	–	–	–		
Pitot Coefficient: C_p	–	–	–	–		
Meter Calibration Factor: Y	1.0	1.0	1.0	1.0		
Area of Nozzle: A_n (in²)	–	–	–	–		
Total Sampling Time: θ (Min.)	21	32	30	30		
Gas Sample Volume: Vm (ft³)	18.124	30.25	27.733	27.5970		
Avg. Velocity Head: $(\sqrt{\Delta p})^2$avg. (in. H_2O)	–	–	–	–		
Avg. Orifice Pressure: ΔH (in H_2O)	3.0	2.9857	2.9857	3.0		
Avg. Stack Temperature: T_s (°R)	–	1741.5	1763.14	1642.3		
Avg. Meter Temperature: T_m (°R)	551.70	556.25	558.286	542.07		
Gas Sample Volume @ Std. Cond.: $Vm(Std)\ (ft^3) = \frac{17.64\ VmY}{Tm}\ (P_{bar} + \Delta H/13.6)$	17.5127	28.9896	26.4805	27.1222		
Volume of Liquid and Silica Gel Collected: V_{lc} ~~(ml.)~~ g				59.67		
Volume of Water Vapor: $Vw\ (Std)\ (ft^3) = 0.04707\ V_{lc}$				2.80867		
Moisture Content: $B_{ws} = \frac{V_w\ (Std)}{Vm(Std) + Vw(Std)}$				0.09384		
Molecular Weight of Stack Gas (dry): $M_d = 0.44\ (\%\ CO_2) + 0.32\ (\%\ O_2) + 0.28\ (\%\ N_2 + \%\ CO)$						

SO_2 CALIBRATION GAS CHECK

SUMMARY OF RESULTS

SO_2

Blank = 0.06

Date	Sampling Location	Run ~~No.~~ Actual Liters	Corrected Sample Volume: V_{mstd} (ft³) SCF	Titrant Volume: V_t (ml)	Total Solution Volume: V_{soln} (ml)	Aliquot Volume: Va (ml)	Titrant Normality: N	SO_2 Concentration C_{SO_2} (lbs/ft³)	SO_2 Concentration C_{SO_2} (ppm)
1/31/84	101513	313.80	305.79/10.80	3.92	500	2	0.010	6.3088×10^{-5}	379.32
298	101514	172.6	164.52/5.8109	2.22	"	"	"	6.5617×10^{-5}	394.52 386
	101515	210.60	200.72/7.0893	2.62	"	"	"	6.3745×10^{-5}	383.26 S=7.89
	101517	281.0	262.13/9.2585	8.36	"	"	"	1.5825×10^{-4}	951.47
880	101520	241.4	225.19/7.9538	7.62	"	"	"	1.6779×10^{-4}	1008.81 997.9
	101522	187.0	174.45/6.1614	6.06	"	"	"	1.7190×10^{-4}	1033.55 S=42.1
	101525	245.0	243.62/8.6045	12.10	"	1	"	4.940×10^{-4}	2970.24
2981	101528	218.0	215.55/7.5938	10.60	"	1	"	4.900×10^{-4}	2946.25 2942
	101527	213.0	209.82/7.4109	10.22	"	1	"	4.840×10^{-4}	2910.15 S=30.2
	101526	206.0	202.17/7.1407	24.84	"	2	"	6.126×10^{-4}	3683
3670	101529	288.04	281.64/9.9475	20.70	"	1	"	7.3254×10^{-4}	4404 $\bar{x}$=3895
	101531	165.11	166.05/5.865	10.00	"	1	"	5.983×10^{-4}	3598 S=443
2/9/84	103957	220	214.32/7.5698	7.27	500 V_{tb}= 0.04	2	0.010	[illegible] $\times 10^{-4}$	1014
	103956	163	158.50/5.5982	5.50	11	2	0.010	1.722×10^{-4}	1035 =1015
	103918	396	385.77/13.6254	12.84	11	2	0.010	1.658×10^{-4}	997 S=19.0
									SO_2-avg = 1007 ppm

Correct to 68°F

$$C_{SO_2} \text{ lb/ft}^3 = \frac{(7.061 \times 10^{-5})\, N\, (V_t - V_{tb})\, (V_{soln}/V_a)}{V_{m_{std}}}$$

1 liter × 0.03532 = 1 ft³ for 880 bottle

$$C_{SO_2} \text{ ppm} = (C_{SO_2} \text{ lb/ft}^3)\,(384.8 \text{ ft}^3/\text{mole})\,(1 \text{ mole}/64 \text{ lbs})\, 10^6$$

APPENDIX C

PHASE I TEST DATA

The following tables list all the valid data obtained during the first phase of this program, the evaluation of the Weiher SM burner. The data is listed in several blocks:

1. The first block identifies the test condition with a flame number, the firing rate or thermal load, burner and overall stoichiometry, swirl setting, combustion air temperatures for each burner passage, and velocities through each passage.

2. The second block lists the flue gas analysis, including the measured O_2 concentration and CO_2, CO, and NO_x corrected to 0 percent O_2. These emissions were measured downstream of a conditioning system and thus are on a dry basis. The other listed gases, SO_2 and SO_3 were analyzed primarily during the sorbent injection tests for SO_x control.

3. The next block characterizes sorbent injection conditions including type of sorbent material, injection location, injection velocity, sorbent flowrate (both mass flow and as Ca/S molar ratio) and SO_2 reduction percentage. For this first phase of tests, tertiary or staging air was directed through the inner set of tertiary ports only. However, the sorbent was injected through both the inner and outer set of ports. The percent of SO_2 captured is calculated based on measured SO_2 concentration with and without sorbent injection. The baseline (without sorbent) SO_2 values used were obtained just prior to sorbent injection. For example, test V22 had a baseline SO_2 concentration of 653 ppm. When Vicron was injected with the coal for test V23, the SO_2 decreased to 497 ppm. SO_2 capture was calculated as SO_2 capture = (653-497)/653 x 100, or 23.9 percent.

4. For selected tests, additional data on fly ash characteristics was obtained including composition and total mass loading.

UTAH COAL

		FLAME NR.	U1	U2	U3	U4	U5	U6	U7
		LOAD, MW	28.5	30.5	31.5	29.5	28.8	31.9	30.1
		SR_B	0.89	0.85	0.85	0.86	0.88	0.56	0.59
		SR_T	1.35	1.28	1.26	1.23	1.27	1.16	1.22
		SWIRL SETTING	5	4	3	2	2	2	4
		T_{pri}, °C	58	65	69	64	66	64	63
		T_{sec}, °C	295	298	299	298	305	282	268
		T_{tert}, °C	239	241	244	237	241	247	242
		V_{pri}, m/s	17.9	18.7	20.6	19.1	19.5	18.3	18.8
		V_{sec}, m/s	25.3	25.8	25.9	24.7	24.8	14.8	14.3
		V_{tert}, m/s	27.7	28.5	28.6	24.2	24.3	42.8	42.1
FLUE GAS ANALYSIS		O_2, % (dry)	5.5	4.7	4.4	4.1	4.5	3.0	3.9
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.3	19.3	18.7	19.5	19.2	19.3	19.4
		CO, ppm (dry)	73	70	65	69	66	76	72
		NO_x, ppm (dry)	557	459	466	427	457	272	314
		SO_2, ppm (wet)							
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE							
		INJECTION LOCATION*							
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min							
		Ca/S							
		% SO_2 CAPTURED							
		FLUE GAS TEMPERATURE, °C	853	871	867	871		899	
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U8	U9	U10	U11	U12	U13	U14
		LOAD, MW	30.3	27.9	33.1	32.4	32.6	32.5	32.9
		SR_B	0.54	0.67	1.11	1.17	1.19	0.87	0.84
		SR_T	1.18	1.21	1.19	1.25	1.27	1.21	1.18
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	64	58	57	61	60	59	54
		T_{sec}, °C	272	277	282	287	291	289	292
		T_{tert}, °C	243	229	140	144	147	221	218
		V_{pri}, m/s	18.3	15.9	16.7	18.3	18.5	18.5	17.7
		V_{sec}, m/s	13.0	16.4	39.0	40.4	41.5	27.8	27.6
		V_{tert}, m/s	42.6	31.9	4.5	4.5	4.6	23.5	23.3
FLUE GAS ANALYSIS		O_2, % (dry)	3.3	3.7	3.4	4.3	4.5	3.7	3.3
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.5	18.9	19.1	19.1	20.1	18.9	19.2
		CO, ppm (dry)	80	60.7	59.7	62.9	63.6	60.7	59.3
		NO_x, ppm (dry)	274	364.2	620.5	653.9	674.5	497.7	439.0
		SO_2, ppm (wet)							
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE							
		INJECTION LOCATION*							
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min							
		Ca/S							
		% SO_2 CAPTURED							
		FLUE GAS TEMPERATURE, °C		885	888	--	--	871	921
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM					12.662		
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U15	U16	U17	U18	U18a	U19	U20
		LOAD, MW	34.5	34.8	34.3	31.9	31.7	15.8	16.1
		SR_B	0.89	0.88	0.88	0.85	0.87	0.78	1.29
		SR_T	1.14	1.13	1.14	1.33	1.35	1.27	1.45
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	60	59	59	48	46	62	68
		T_{sec}, °C	282	284	282	283	281	338	335
		T_{tert}, °C	200	202	199	223	222	262	169
		V_{pri}, m/s	16.8	17.0	16.9	20.0	20.3	14.4	17.9
		V_{sec}, m/s	31.1	31.2	30.8	25.7	25.8	11.0	21.0
		V_{tert}, m/s	17.6	17.4	17.6	32.1	32.1	17.6	4.8
FLUE GAS ANALYSIS		O_2, % (dry)	2.6	2.4	2.6	5.3	5.5	4.5	6.6
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.2	18.7	18.9	19.3	19.0	18.3	18.1
		CO, ppm (dry)	63	57	51	54	54	102	88
		NO_x, ppm (dry)	485	474	502	522	528	242	438
		SO_2, ppm (wet)							
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE							
		INJECTION LOCATION*							
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min							
		Ca/S							
		% SO_2 CAPTURED							
		FLUE GAS TEMPERATURE, °C	906	--				760	744
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM		11.130					
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U21	U22	U23	U24	U25	U26	U27
		LOAD, MW	13.8	14.4	13.5	13.2	14.4	29.5	30.0
		SR_B	0.87	0.80	0.79	0.81	0.72	0.79	0.77
		SR_T	1.22	1.18	1.24	1.26	1.13	1.20	1.20
		SWIRL SETTING	5	5	5	5	5	4	4
		T_{pri}, °C	59	59	59	59	59	59	59
		T_{sec}, °C	334	364	371	368	376	333	331
		T_{tert}, °C	231	266	291	285	284	253	258
		V_{pri}, m/s	17.3	17.1	15.8	17.1	15.8	18.0	17.3
		V_{sec}, m/s	8.7	8.5	7.9	7.3	7.5	23.9	23.8
		V_{tert}, m/s	10.6	12.6	14.3	14.1	14.1	27.2	29.1
FLUE GAS ANALYSIS		O_2, % (dry)	3.9	3.3	4.1	4.4	2.5	3.6	3.5
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.4	18.5	18.6	18.5	18.2	18.1	18.2
		CO, ppm (dry)	92	95	87	89	91	85	66
		NO_x, ppm (dry)	454	368	423	430	284	326	336
		SO_2, ppm (wet)	590	653	497	582	431	724	504
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE			Vicron		Vicron		Vicron
		INJECTION LOCATION*			Mill		Mill		Mill
		INJECTION VELOCITY, m/s			--		--		--
		$\dot{M}_{sorb}$, kg/min			0.77		1.78		1.78
		Ca/S			0.97		2.09		1.01
		% SO_2 CAPTURED			23.9		25.9		30.4
		FLUE GAS TEMPERATURE, °C	741				754		902
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS	←— Detached Flames —→						

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U28	U29	U30	U31*	U32	U33	U34
		LOAD, MW	30.2	28.5	28.5	31.1	31.8	30.8	29.2
		SR_B	0.77	0.81	1.26	1.15	1.15	1.18	1.22
		SR_T	1.20	1.26	1.35	1.23	1.23	1.26	1.31
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	61	60	57	60	59	58	61
		T_{sec}, °C	335	341	302	307	312	308	323
		T_{tert}, °C	260	267	160	147	146	147	166
		V_{pri}, m/s	17.6	17.8	16.1	17.7	17.1	16.2	17.2
		V_{sec}, m/s	24.0	24.0	39.6	39.2	41.0	40.7	40.6
		V_{tert}, m/s	29.3	29.4	4.6	4.5	4.4	4.5	4.4
FLUE GAS ANALYSIS		O_2, % (dry)	3.5	4.4	5.5	4.0	4.0	4.4	5.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.5	18.7	17.6	18.0	17.8	18.2	19.2
		CO, ppm (dry)	60	63	61	56	56	57	59
		NO_x, ppm (dry)	336	380	677	618	618	645	700
		SO_2, ppm (wet)	408	380	---	642	494	531	735
		wet chem SO_2, ppm					297		
		wet chem SO_3, ppm					0.57		
SORBENT		SORBENT TYPE	Vicron	Vicron			Vicron	Vicron	
		INJECTION LOCATION*	Mill	Mill			Mill	Mill	
		INJECTION VELOCITY, m/s	--	--			--	--	
		M_{sorb}, kg/min	3.47	3.47			1.78	1.78	
		Ca/S	1.95	2.07			0.95	0.98	
		% SO_2 CAPTURED	43.7	47.5			23.1	17.3	
		FLUE GAS TEMPERATURE, °C				871	887	913	
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM				8.336		13.636	
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U35	U36	U37	U38	U39	U40
		LOAD, MW	30.1	31.1	30.0	28.1	32.6	29.2
		SR_B	1.19	1.18	1.32	1.28	1.11	0.80
		SR_T	1.27	1.26	1.41	1.38	1.20	1.28
		SWIRL SETTING	4	4	4	4	4	4
		T_{pri}, °C	59	61	62	63	61	64
		T_{sec}, °C	321	311	250	310	314	301
		T_{tert}, °C	147	149	123	142	147	233
		V_{pri}, m/s	16.7	17.1	17.2	16.9	18.3	20.0
		V_{sec}, m/s	40.7	41.2	40.2	40.8	40.7	22.2
		V_{tert}, m/s	4.4	4.4	4.8	4.9	4.8	30.7
FLUE GAS ANALYSIS		O_2, % (dry)	4.5	4.4	6.2	5.9	3.5	4.7
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.3	18.0	17.9	18.4	18.2	18.3
		CO, ppm (dry)	51	51	64	56	54	52
		NO_x, ppm (dry)	700	671	639	668	696	464
		SO_2, ppm (wet)	407	506	682	668	528	618
		wet chem SO_2, ppm					453	
		wet chem SO_3, ppm					0.1	
SORBENT		SORBENT TYPE	Vicron	Vicron			Vicron	
		INJECTION LOCATION*	Mill	Mill			IT	
		INJECTION VELOCITY, m/s	--	--				
		$\dot{M}_{sorb}$, kg/min	3.47	3.47			3.47	
		Ca/S	1.95	1.89			1.81	
		% SO_2 CAPTURED	44.6	31.2			21.0	
		FLUE GAS TEMPERATURE, °C	921					962
FLYASH ANALYSIS (DRY)		% C						
		% H						
		% O (by diff.)						
		% N						
		% S						
		% CaO						
		% Ash						
		TOTAL MASS LOADING, gr/DNCM	11.662				20.597	11.705
		FURNACE RETENTION, %						
		COMMENTS						

UTAH COAL

FLAME NR.			U40a	U41	U42	U43	U44	U45	U46
LOAD, MW			31.2	25.9	31.0	35.0	33.3	31.5	31.8
SR_B			0.80	0.88	0.82	0.82	0.77	0.82	0.81
SR_T			1.24	1.28	1.24	1.19	1.20	1.26	1.26
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			62	63	62	61	63	62	61
T_{sec}, °C			301	295	309	312	314	316	314
T_{tert}, °C			234	224	246	242	242	252	248
V_{pri}, m/s			18.3	30.0	20.2	20.0	20.2	20.5	20.4
V_{sec}, m/s			25.2	21.4	24.9	30.0	26.1	25.9	26.1
V_{tert}, m/s			29.6	22.1	29.4	28.3	31.2	30.8	31.3
FLUE GAS ANALYSIS		O_2, % (dry)	4.2	4.7	4.2	3.4	3.6	4.4	4.4
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.3	18.3	17.8	17.9	17.9	18.0	18.0
		CO, ppm (dry)	50	52	50	48	48	51	51
		NO_x, ppm (dry)	500	496	463	489	434	474	481
		SO_2, ppm (wet)	625	412	600	---	483	455	354
		wet chem SO_2, ppm		297	333				
		wet chem SO_3, ppm		0.47	0.33				
SORBENT	SORBENT TYPE			Vicron			Vicron	Vicron	Vicron
	INJECTION LOCATION*			Mill			OT	OT	OT
	INJECTION VELOCITY, m/s			--					
	$\dot{M}_{sorb}$, kg/min			3.47			1.78	1.78	3.47
	Ca/S			2.26			0.90	0.90	1.85
% SO_2 CAPTURED				34.1			19.5	24.2	41.0
FLUE GAS TEMPERATURE, °C			971					861	875
FLYASH ANALYSIS (DRY)	% C								
	% H								
	% O (by diff.)								
	% N								
	% S								
	% CaO								
	% Ash								
TOTAL MASS LOADING, gr/DNCM					9.004		12.366		
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

			U47	U48	U49	U50	U51	U52	U53
FLAME NR.			U47	U48	U49	U50	U51	U52	U53
LOAD, MW			32.5	31.4	33.1	33.0	31.3	30.4	29.3
SR_B			0.80	0.82	0.77	0.79	0.81	0.83	0.86
SR_T			1.23	1.26	1.19	1.22	1.25	1.29	1.33
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			63	63	62	63	63	63	62
T_{sec}, °C			318	328	332	313	317	326	316
T_{tert}, °C			257	262	269	246	252	261	256
V_{pri}, m/s			21.1	20.5	19.2	19.8	20.3	21.2	20.3
V_{sec}, m/s			26.0	26.4	26.5	25.9	24.8	25.2	24.6
V_{tert}, m/s			31.7	31.6	31.8	31.2	31.2	31.8	31.4
FLUE GAS ANALYSIS		O_2, % (dry)	4.0	4.4	3.4	3.8	4.3	4.8	5.3
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.8	18.0	17.9	18.1	18.1	18.1	17.9
		CO, ppm (dry)	49	44	44	45	50	52	47
		NO_x, ppm (dry)	445	468	442	464	465	493	515
		SO_2, ppm (wet)	507	506	668	342	654	467	482
		wet chem SO_2, ppm	289						
		wet chem SO_3, ppm	0.12						
SORBENT		SORBENT TYPE	Vicron	Vicron		Vicron		Vicron	Vicron
		INJECTION LOCATION*	OT	OT		OT		IT	IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	3.47	3.47		7.01		1.78	1.78
		Ca/S	1.81	1.88		3.60		0.99	1.03
% SO_2 CAPTURED			24.2	24.3		37.9		28.6	26.3
FLUE GAS TEMPERATURE, °C									
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
TOTAL MASS LOADING, gr/DNCM			17.256					12.376	
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U54	U55	U56	U57	U58	U59	U60
		LOAD, MW	30.4	29.5	28.9	30.4	31.0	30.8	30.9
		SR_B	0.83	0.86	0.86	0.84	0.82	0.82	0.84
		SR_T	1.29	1.33	1.35	1.31	1.27	1.27	1.31
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	63	63	62	63	63	63	67
		T_{sec}, °C	312	321	314	306	303	319	318
		T_{tert}, °C	257	259	249	245	242	253	254
		V_{pri}, m/s	20.3	21.2	20.4	21.8	21.1	21.1	22.8
		V_{sec}, m/s	24.8	24.8	24.4	25.2	25.1	25.6	26.2
		V_{tert}, m/s	31.4	31.5	31.3	30.9	30.4	30.6	32.2
FLUE GAS ANALYSIS		O_2, % (dry)	4.8	5.3	5.5	5.0	4.5	4.5	5.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.9	18.2	18.2	18.1	18.1	17.6	17.6
		CO, ppm (dry)	52	47	47	53	47	47	46
		NO_x, ppm (dry)	506	508	528	473	446	446	459
		SO_2, ppm (wet)	363	375	244	656	484	636	263
		wet chem SO_2, ppm	387						
		wet chem SO_3, ppm	0						
SORBENT		SORBENT TYPE	Vicron	Vicron	Vicron		Vicron		Vicron
		INJECTION LOCATION*	IT	IT	IT		IT		IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	1.78	1.78	7.01		2.63		5.16
		Ca/S	1.93	1.99	4.11		1.44		2.83
% SO_2 CAPTURED			44.5	42.7	62.7		26.2		58.7
FLUE GAS TEMPERATURE, °C							982		976
FLYASH ANALYSIS (DRY)		% C				13.22			
		% H				0.42			
		% O (by diff.)							
		% N				0.13			
		% S				3.55			
		% CaO							
		% Ash				79.98			
TOTAL MASS LOADING, gr/DNCM						10.358			
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

FLAME NR.			U61	U62	U63	U64	U65	U66	U67
LOAD, MW			30.7	30.3	30.9	30.6	30.8	30.0	30.2
SR_B			0.86	0.86	0.84	0.84	0.84	0.86	0.85
SR_T			1.32	1.33	1.31	1.31	1.31	1.33	1.32
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			69	66	64	64	63	66	66
T_{sec}, °C			303	312	309	323	311	309	306
T_{tert}, °C			246	251	249	259	246	247	245
V_{pri}, m/s			23.1	22.6	22.6	22.5	22.5	22.2	22.0
V_{sec}, m/s			25.7	26.1	25.8	26.1	25.8	25.7	25.6
V_{tert}, m/s			31.6	31.6	31.7	32.1	31.4	31.3	31.3
FLUE GAS ANALYSIS		O_2, % (dry)	5.2	5.3	5.0	5.0	5.0	5.3	5.2
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.5	18.4	17.6	17.6	17.9	17.9	17.5
		CO, ppm (dry)	49	47	49	46	47	47	48
		NO_x, ppm (dry)	465	501	473	492	459	495	452
		SO_2, ppm (wet)	665	390	643	263	669	428	665
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		$Ca(OH)_2$		$Ca(OH)_2$		Vicron	
		INJECTION LOCATION*		IT		IT		Mill	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		1.97		3.89		2.63	
		Ca/S		1.48		2.89		1.48	
% SO_2 CAPTURED				41.4		59.1		36.0	
FLUE GAS TEMPERATURE, °C			933		958	983	954	965	
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
TOTAL MASS LOADING, gr/DNCM									
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U67a	U68	U68a	U69	U69a	U69b	U69c
		LOAD, MW	30.4	30.6	31.3	29.9	30.1	30.9	30.4
		SR_B	0.84	0.84	0.82	0.83	0.82	0.80	0.81
		SR_T	1.31	1.31	1.27	1.27	1.25	1.22	1.24
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	63	64	63	64	67	66	68
		T_{sec}, °C	313	307	309	295	293	307	316
		T_{tert}, °C	255	247	249	243	239	248	257
		V_{pri}, m/s	21.3	21.5	21.6	19.0	19.2	20.0	20.3
		V_{sec}, m/s	25.9	25.7	25.8	24.8	24.3	24.9	25.2
		V_{tert}, m/s	31.6	31.3	31.3	29.1	28.7	29.0	29.5
FLUE GAS ANALYSIS		O_2, % (dry)	5.0	5.0	4.6	4.6	4.3	3.9	4.2
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.4	18.9	18.8	18.4	18.6	18.4	18.3
		CO, ppm (dry)	43	49	46	47	44	43	38
		NO_x, ppm (dry)	459	486	442	423	402	393	425
		SO_2, ppm (wet)	656	394	410	692	629	737	725
		wet chem SO_2, ppm		233					
		wet chem SO_3, ppm		0.26					
SORBENT		SORBENT TYPE		Vicron	Vicron				
		INJECTION LOCATION*		Mill	Mill				
		INJECTION VELOCITY, m/s		--					
		$\dot{M}_{sorb}$, kg/min		5.16	5.16				
		Ca/S		2.86	2.79				
		% SO_2 CAPTURED		40.1	37.5				
		FLUE GAS TEMPERATURE, °C		949		960		953	943
FLYASH ANALYSIS (DRY)		% C						6.70	
		% H						0.12	
		% O (by diff.)							
		% N						0.09	
		% S						2.28	
		% CaO							
		% Ash						91.23	
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

			U70	U71	U72	U73	U73a	U74	U75
FLAME NR.			U70	U71	U72	U73	U73a	U74	U75
LOAD, MW			29.2	29.5	29.5	28.8	29.1	29.6	27.5
SR_B			0.85	0.84	0.85	0.87	0.85	0.84	0.85
SR_T			1.30	1.28	1.29	1.32	1.30	1.28	1.31
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			69	67	69	72	69	68	69
T_{sec}, °C			313	308	310	311	308	313	314
T_{tert}, °C			249	251	249	251	251	257	258
V_{pri}, m/s			21.0	20.7	20.8	21.1	20.0	19.9	20.1
V_{sec}, m/s			24.9	24.7	25.0	25.2	25.0	25.3	25.4
V_{tert}, m/s			29.1	29.1	29.2	29.0	29.1	29.6	29.8
FLUE GAS ANALYSIS		O_2, % (dry)	4.9	4.7	4.8	5.2	4.9	4.7	5.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.5	18.3	18.4	18.1	18.0	18.4	18.1
		CO, ppm (dry)	39	45	40	44	46	43	39
		NO_x, ppm (dry)	457	451	454	473	457	483	459
		SO_2, ppm (wet)	483	722	389	665	704	490	709
		wet chem SO_2, ppm			288				
		wet chem SO_3, ppm			0.59				
SORBENT		SORBENT TYPE	Vicron		Vicron			Vicron	
		INJECTION LOCATION*	IT		IT			Mill	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	2.63		5.16			3.47	
		Ca/S	1.52		2.97			1.99	
% SO_2 CAPTURED			33.4		46.1			30.4	
FLUE GAS TEMPERATURE, °C			942	944	983	906	901	970	946
FLYASH ANALYSIS (DRY)		% C			3.80				
		% H			0.06				
		% O (by diff.)							
		% N			0.04				
		% S			2.26				
		% CaO							
		% Ash			94.66				
TOTAL MASS LOADING, gr/DNCM					14.726				
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

FLAME NR.			U76	U77	U77a	U78	U79	U80	U80a
LOAD, MW			29.4	29.5	30.7	29.8	29.5	28.5	29.6
SR_B			0.85	0.81	0.77	0.80	0.81	0.83	0.81
SR_T			1.29	1.26	1.20	1.24	1.26	1.28	1.26
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			66	66	67	69	68	68	68
T_{sec}, °C			313	289	289	298	286	291	289
T_{tert}, °C			254	245	239	252	242	244	243
V_{pri}, m/s			19.7	20.8	19.4	20.4	20.5	20.3	20.3
V_{sec}, m/s			25.4	22.6	22.7	23.0	22.6	22.6	22.8
V_{tert}, m/s			29.4	29.5	29.0	29.7	29.2	29.2	29.4
FLUE GAS ANALYSIS		O_2, % (dry)	4.8	4.4	3.6	4.2	4.4	4.7	4.4
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.4	19.2	18.7	18.8	18.7	19.1	18.7
		CO, ppm (dry)	40	56	46	56	57	58	57
		NO_x, ppm (dry)	506	367	362	394	405	425	411
		SO_2, ppm (wet)	363	708	700	575	708	490	455
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT	SORBENT TYPE		Vicron			Vicron		Vicron	Vicron
	INJECTION LOCATION*		Mill			IT		IT	IT
	INJECTION VELOCITY, m/s								
	$\dot{M}_{sorb}$, kg/min		6.85			0.94		3.47	3.47
	Ca/S		3.25			0.53		2.07	1.99
% SO_2 CAPTURED			48.8			17.9		35.0	35.7
FLUE GAS TEMPERATURE, °C			977	984	984	----	887	880	887
FLYASH ANALYSIS (DRY)	% C								
	% H								
	% O (by diff.)								
	% N								
	% S								
	% CaO								
	% Ash								
TOTAL MASS LOADING, gr/DNCM				9.447					
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

UTAH COAL

		FLAME NR.	U81						
		LOAD, MW	29.1						
		SR_B	0.82						
		SR_T	1.09						
		SWIRL SETTING	4						
		T_{pri}, °C	68						
		T_{sec}, °C	320						
		T_{tert}, °C	246						
		V_{pri}, m/s	20.1						
		V_{sec}, m/s	24.2						
		V_{tert}, m/s	17.3						
FLUE GAS ANALYSIS		O_2, % (dry)	1.8						
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.6						
		CO, ppm (dry)	53						
		NO_x, ppm (dry)	295						
		SO_2, ppm (wet)	--						
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE							
		INJECTION LOCATION*							
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min							
		Ca/S							
		% SO_2 CAPTURED							
		FLUE GAS TEMPERATURE, °C	903						
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

INDIANA COAL

		FLAME NR.	I1	I2	I2a	I3	I3a	I3b	I4
		LOAD, MW	29.4	29.7	29.9	28.6	28.7	28.6	28.6
		SR_B	0.86	0.65	0.64	1.16	1.15	1.17	1.16
		SR_T	1.28	1.27	1.25	1.27	1.25	1.27	1.26
		SWIRL SETTING	5	5	5	5	5	5	5
		T_{pri}, °C	62	62	63	61	62	62	62
		T_{sec}, °C	323	312	313	333	332	330	328
		T_{tert}, °C	239	281	284	174	163	161	159
		V_{pri}, m/s	20.4	20.1	20.1	19.7	19.8	19.8	19.4
		V_{sec}, m/s	25.1	16.9	16.9	36.4	36.1	36.4	36.0
		V_{tert}, m/s	25.9	42.4	42.3	5.5	5.3	5.2	5.2
FLUE GAS ANALYSIS		O_2, % (dry)	4.6	4.5	4.3	4.5	4.3	4.5	4.4
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.7	19.6	19.4	19.6	19.4	19.6	19.7
		CO, ppm (dry)	47	47	50	51	49	45	44
		NO_x, ppm (dry)	551	395	390	726	729	751	759
		SO_2, ppm (wet)	1140	1273	1207	1146	1094	1273	835
		wet chem SO_2, ppm					991		
		wet chem SO_3, ppm					4.7		
SORBENT		SORBENT TYPE							Vicron
		INJECTION LOCATION*							IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min							4.82
		Ca/S							1.54
		% SO_2 CAPTURED							34.4
		FLUE GAS TEMPERATURE, °C	957	964	964	981	989	981	1005
FLYASH ANALYSIS (DRY)		% C	4.31	9.99		12.07 9.94			
		% H	0.32	0.32		0.30 0.08			
		% O (by diff.)							
		% N	0.11	0.10		0.14 0.08			
		% S	4.52	4.45		3.40 0.19			
		% CaO				14.3			
		% Ash	83.10	84.76		83.53 87.20			
		TOTAL MASS LOADING, gr/DNCM				12.363			
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

INDIANA COAL

		FLAME NR.	I5	I6	I7	I8	I9	I10	I11
		LOAD, MW	29.2	28.7	29.1	28.9	29.1	28.6	31.0
		SR_B	1.14	1.16	1.13	1.14	1.14	1.15	0.82
		SR_T	1.24	1.26	1.23	1.24	1.23	1.25	1.28
		SWIRL SETTING	5	5	5	5	5	5	5
		T_{pri}, °C	61	62	61	62	62	62	64
		T_{sec}, °C	333	323	323	330	326	330	288
		T_{tert}, °C	166	159	160	169	164	172	237
		V_{pri}, m/s	19.3	19.2	17.8	17.9	18.0	18.2	19.2
		V_{sec}, m/s	36.5	36.1	36.1	36.5	36.4	36.4	24.2
		V_{tert}, m/s	5.2	5.2	5.1	5.4	5.0	5.4	30.0
FLUE GAS ANALYSIS		O_2, % (dry)	4.1	4.4	4.0	4.1	4.0	4.3	4.6
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.6	20.2	19.5	19.6	18.8	19.1	18.7
		CO, ppm (dry)	46	51	46	44	43	47	47
		NO_x, ppm (dry)	721	759	741	770	741	780	525
		SO_2, ppm (wet)	1243	658	1161	870	1211	629	1127
		wet chem SO_2, ppm							941
		wet chem SO_3, ppm							5.5
SORBENT		SORBENT TYPE		Vicron		Vicron		Vicron	
		INJECTION LOCATION*		IT		Mill		Mill	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		9.71		4.82		9.71	
		Ca/S		3.08		1.52		3.09	
		% SO_2 CAPTURED		47.1		25.1		48.1	
		FLUE GAS TEMPERATURE, °C	989	1003	1014	1004			978
FLYASH ANALYSIS (DRY)		% C				14.06			9.87
		% H				0.40			0.14
		% O (by diff.)							
		% N				0.09			0.11
		% S				3.23			1.51
		% CaO							10.9
		% Ash				84.39			88.68
		TOTAL MASS LOADING, gr/DNCM							11.271
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

INDIANA COAL

		FLAME NR.	I11a	I23	I24	I12	I11b	I11c	I24a
		LOAD, MW	30.6	30.9	30.6	30.8	30.6	30.0	29.3
		SR_B	0.82	0.80	0.81	0.80	0.80	0.81	0.85
		SR_T	1.28	1.25	1.26	1.25	1.26	1.27	1.28
		SWIRL SETTING	5	5	5	5	5	5	5
		T_{pri}, °C	63	63	62	63	63	61	64
		T_{sec}, °C	284	291	294	304	301	306	295
		T_{tert}, °C	241	243	239	247	243	250	240
		V_{pri}, m/s	19.4	19.0	19.5	19.4	19.3	19.2	18.6
		V_{sec}, m/s	23.4	23.5	23.4	23.8	23.5	23.7	23.9
		V_{tert}, m/s	30.0	29.6	29.4	29.6	30.1	29.5	27.1
FLUE GAS ANALYSIS		O_2, % (dry)	4.6	4.2	4.4	4.2	4.4	4.5	4.7
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.7	18.8	18.7	18.8	18.5	19.1	19.3
		CO, ppm (dry)	49	44	44	44	44	46	50
		NO_x, ppm (dry)	525	513	512	513	519	509	548
		SO_2, ppm (wet)	1127	1063	1252	900	1215	1273	1314
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		Vicron		Vicron			
		INJECTION LOCATION*		IT		IT			
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		1.61		4.82			
		Ca/S		0.48		1.43			
		% SO_2 CAPTURED		5.7		28.1			
		FLUE GAS TEMPERATURE, °C	973		978		1006		975
FLYASH ANALYSIS (DRY)		% C			12.37				
		% H			0.24				
		% O (by diff.)							
		% N			0.17				
		% S			1.50				
		% CaO							
		% Ash			85.11				
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

INDIANA COAL

		FLAME NR.	I12a	I14	I13a	I14a	I14b	I15	I16
		LOAD, MW	29.9	30.6	30.1	31.3	29.8	30.1	30.3
		SR_B	0.82	0.78	0.79	0.76	0.80	0.78	0.79
		SR_T	1.25	1.23	1.25	1.20	1.26	1.24	1.24
		SWIRL SETTING	5	5	5	5	5	5	5
		T_{pri}, °C	64	64	62	63	63	62	63
		T_{sec}, °C	299	297	298	303	305	309	321
		T_{tert}, °C	243	246	242	249	252	254	263
		V_{pri}, m/s	18.5	18.5	17.9	18.9	19.2	19.1	19.5
		V_{sec}, m/s	23.9	22.7	22.7	22.8	22.6	22.6	23.2
		V_{tert}, m/s	27.2	29.7	29.4	29.9	30.1	30.0	30.4
FLUE GAS ANALYSIS		O_2, % (dry)	4.2	4.0	4.2	3.6	4.4	4.1	4.1
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.5	19.5	19.0	19.3	19.2	18.9	18.9
		CO, ppm (dry)	50	46	50	48	51	45	44
		NO_x, ppm (dry)	525	500	525	495	531	497	497
		SO_2, ppm (wet)	963	815	1325	869	759	1367	1056
		wet chem SO_2, ppm		620					
		wet chem SO_3, ppm		0.33					
SORBENT		SORBENT TYPE	Vicron	Vicron		Vicron	Vicron		$Ca(OH)_2$
		INJECTION LOCATION*	IT	IT		IT	IT		IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	4.82	9.88		9.88	9.88		
		Ca/S	1.47	2.94		2.88	3.03		1.43
		% SO_2 CAPTURED	26.7	40.0		34.4	42.7		22.8
		FLUE GAS TEMPERATURE, °C	984	1027		1015		1024	1018
FLYASH ANALYSIS (DRY)		% C		6.57					
		% H		0.14					
		% O (by diff.)		0.0					
		% N		0.09					
		% S		2.25					
		% CaO		27.2					
		% Ash		91.78					
		TOTAL MASS LOADING, gr/DNCM		24.009					
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

INDIANA COAL

		FLAME NR.	I17	I18	I18a	I19	I20	I20a	I21
		LOAD, MW	29.8	30.5	30.9	30.7	30.2	30.5	30.9
		SR_B	0.79	0.77	0.77	0.77	0.77	0.76	0.76
		SR_T	1.25	1.22	1.21	1.22	1.23	1.21	1.20
		SWIRL SETTING	5	5	5	5	5	5	5
		T_{pri}, °C	62	62	62	62	61	62	62
		T_{sec}, °C	302	302	304	299	295	304	302
		T_{tert}, °C	243	247	249	244	243	247	247
		V_{pri}, m/s	19.0	18.8	19.3	18.9	17.6	17.4	17.8
		V_{sec}, m/s	22.8	22.5	22.5	22.3	22.2	22.5	22.6
		V_{tert}, m/s	29.6	29.5	29.7	29.4	29.5	29.5	29.8
FLUE GAS ANALYSIS		O_2, % (dry)	4.3	3.9	3.7	3.8	4.0	3.7	3.6
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.9	18.9	18.9	18.8	19.0	18.9	18.8
		CO, ppm (dry)	44	43	46	49	43	43	42
		NO_x, ppm (dry)	503	504	486	464	507	486	459
		SO_2, ppm (wet)	1635	786	850	1465	1137	1141	1376
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		$Ca(OH)_2$	$Ca(OH)_2$		Vicron	Vicron	
		INJECTION LOCATION*		IT	IT		Mill	Mill	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		7.14	7.14		4.82	4.82	
		Ca/S		2.87	2.83		1.46	1.47	
		% SO_2 CAPTURED		51.9	48.0		22.4	22.1	
		FLUE GAS TEMPERATURE, °C	996				1006	1006	
FLYASH ANALYSIS (DRY)		% C		4.37					
		% H		0.08					
		% O (by diff.)		0.0					
		% N		0.07					
		% S		2.24					
		% CaO							
		% Ash		94.74					
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

INDIANA COAL

FLAME NR.			I22	I21a					
LOAD, MW			29.7	30.7					
SR_B			0.79	0.77					
SR_T			1.25	1.22					
SWIRL SETTING			5	5					
T_{pri}, °C			62	63					
T_{sec}, °C			302	313					
T_{tert}, °C			249	254					
V_{pri}, m/s			17.7	18.7					
V_{sec}, m/s			22.7	22.9					
V_{tert}, m/s			29.6	30.0					
FLUE GAS ANALYSIS		O_2, % (dry)	4.3	3.8					
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.1	19.0					
		CO, ppm (dry)	44	43					
		NO_x, ppm (dry)	528	464					
		SO_2, ppm (wet)	805	1343					
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE	Vicron						
		INJECTION LOCATION*	Mill						
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	9.88						
		Ca/S	3.04						
% SO_2 CAPTURED			41.5						
FLUE GAS TEMPERATURE, °C									
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
TOTAL MASS LOADING, gr/DNCM									
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR DATA

		FLAME NR.	S1	S2	S3	S4	S5	S6	S7
		LOAD, MW	27.9	25.1	27.1	29.1	29.6	30.8	19.9
		SR_B	0.79	0.88	0.58	0.86	0.83	0.80	0.85
		SR_T	1.24	1.36	1.23	1.13	1.29	1.22	1.23
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	66	71	74	64	64	63	64
		T_{sec}, °C	279	299	326	324	297	295	295
		T_{tert}, °C	229	243	278	248	252	249	226
		V_{pri}, m/s	19.1	19.9	18.8	20.6	21.6	20.6	25.2
		V_{sec}, m/s	22.3	22.8	14.4	27.6	25.5	25.8	13.3
		V_{tert}, m/s	29.0	29.3	45.5	18.9	33.2	31.6	17.6
FLUE GAS ANALYSIS		O_2, % (dry)	4.1	5.7	4.0	2.4	4.8	3.9	4.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	19.1	17.8	19.3	18.5	18.4	18.2	18.5
		CO, ppm (dry)	68	69	70	68	65	61	68
		NO_x, ppm (dry)	379	419	297	384	402	418	371
		SO_2, ppm (wet)	721	659	593	723	674	663	593
		wet chem SO_2, ppm						557	
		wet chem SO_3, ppm						0.10	
SORBENT		SORBENT TYPE							
		INJECTION LOCATION*							
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min							
		Ca/S							
		% SO_2 CAPTURED							
		FLUE GAS TEMPERATURE, °C	969	966					
FLYASH ANALYSIS (DRY)		% C	28.76 34.83			36.76		35.87 33.98	
		% H	0.27 0.29			0.42		0.27 0.24	
		% O (by diff.)	0.34 1.58			1.24		0.31 0.70	
		% N	0.29 0.29			0.44		0.37 0.34	
		% S	0.95 0.34			0.74		0.63 0.42	
		% CaO							
		% Ash	69.39 62.67			60.40		62.55 64.32	
		TOTAL MASS LOADING, gr/DNCM	12.168		10.699				
		FURNACE RETENTION, %							
		COMMENTS	Hi Vol IFRF					Hi Vol IFRF	

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR DATA

		FLAME NR.	S8	S9	S10	S11	S11a	S12	S13
		LOAD, MW	29.7	30.3	29.6	29.9	29.7	30.0	29.7
		SR_B	1.18	1.15	0.89	0.87	0.87	0.86	0.88
		SR_T	1.26	1.22	1.24	1.20	1.21	1.19	1.21
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	63	63	62	62	62	62	63
		T_{sec}, °C	310	317	285	294	297	297	300
		T_{tert}, °C	147	147	225	229	232	231	234
		V_{pri}, m/s	20.1	20.0	21.5	21.5	21.3	21.3	21.9
		V_{sec}, m/s	41.6	41.9	27.8	27.7	27.6	27.6	28.1
		V_{tert}, m/s	4.7	4.6	23.7	23.5	23.6	23.3	23.4
FLUE GAS ANALYSIS		O_2, % (dry)	4.4	3.9	4.1	3.6	3.7	3.4	3.8
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.2	18.2	17.1	17.4	17.2	17.4	17.8
		CO, ppm (dry)	63	61	62	60	61	60	67
		NO_x, ppm (dry)	538	553	410	398	401	394	414
		SO_2, ppm (wet)	633	663	609	483	455	609	341
		wet chem SO_2, ppm	591						
		wet chem SO_3, ppm	0.10						
SORBENT		SORBENT TYPE				Vicron	Vicron		Vicron
		INJECTION LOCATION*				IT	IT		IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min				2.63	2.63		5.33
		Ca/S				1.45	1.46		2.96
		% SO_2 CAPTURED				20.7	25.3		44.0
		FLUE GAS TEMPERATURE, °C				927			927
FLYASH ANALYSIS (DRY)		% C	34.93			33.60 23.54			28.4
		% H	0.35			0.27 0.18			0.24
		% O (by diff.)	0.79			0.05 0.0			0.47
		% N	0.44			0.38 0.24			0.31
		% S	0.67			1.10 1.76			1.36
		% CaO							17.4
		% Ash	62.82			64.60 74.72			69.22
		TOTAL MASS LOADING, gr/DNCM	12.50			15.402			17.467
		FURNACE RETENTION, %							
		COMMENTS				Hi Vol IFRF			

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR DATA

		FLAME NR.	S14	S14a	S15	S16	S17	S18	S19
		LOAD, MW	30.5	28.3	28.6	29.0	29.9	30.2	30.3
		SR_B	0.87	0.91	0.90	0.91	0.88	0.87	0.88
		SR_T	1.19	1.26	1.25	1.25	1.21	1.19	1.20
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	62	62	63	64	62	63	63
		T_{sec}, °C	299	296	294	299	295	303	297
		T_{tert}, °C	235	232	227	231	229	235	233
		V_{pri}, m/s	21.5	18.5	18.3	20.9	20.5	20.9	21.1
		V_{sec}, m/s	28.6	28.4	28.5	28.7	28.3	28.5	28.8
		V_{tert}, m/s	23.0	23.3	23.2	23.3	23.3	23.4	23.2
FLUE GAS ANALYSIS		O_2, % (dry)	3.4	4.4	4.3	4.3	3.7	3.5	3.6
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.2	18.0	18.1	18.0	18.2	18.0	17.9
		CO, ppm (dry)	66	70	63	63	61	60	60
		NO_x, ppm (dry)	406	405	409	415	388	384	386
		SO_2, ppm (wet)	549	658	465	604	364	600	507
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE			$CaCO_3$		$CaCO_3$		$Ca(OH)_2$
		INJECTION LOCATION*			IT		IT		IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min			2.89		5.66		0.40
		Ca/S			1.68		3.14		0.30
		% SO_2 CAPTURED			29.3		39.7		15.5
		FLUE GAS TEMPERATURE, °C			927				
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM			14.640				
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S20	S21	S22	S22a	S23	S24	S28
		LOAD, MW	29.8	29.9	29.9	29.7	29.8	30.1	30.8
		SR_B	0.87	0.88	0.87	0.88	0.86	0.87	0.88
		SR_T	1.20	1.21	1.20	1.22	1.19	1.19	1.26
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	64	63	63	63	63	63	63
		T_{sec}, °C	301	301	306	295	308	297	289
		T_{tert}, °C	232	229	231	228	231	228	229
		V_{pri}, m/s	20.4	20.7	20.8	20.6	20.3	20.8	19.6
		V_{sec}, m/s	28.5	28.8	28.8	28.4	28.6	28.4	28.9
		V_{tert}, m/s	23.3	23.7	23.3	23.2	23.3	23.0	27.7
FLUE GAS ANALYSIS		O_2, % (dry)	3.7	3.8	3.7	3.8	3.5	3.5	4.4
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.9	18.0	18.2	17.8	18.2	18.0	18.0
		CO, ppm (dry)	61	55	55	55	55	60	51
		NO_x, ppm (dry)	387	414	387	391	396	396	493
		SO_2, ppm (wet)	605	341	581	659	312	420	633
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		$Ca(OH)_2$			$Ca(OH)_2$	$Ca(OH)_2$	
		INJECTION LOCATION*		IT			IT	IT	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		1.97			4.49	1.97	
		Ca/S		1.46			3.35	1.45	
		% SO_2 CAPTURED		43.6			52.7	36.3	
		FLUE GAS TEMPERATURE, °C	954						937
FLYASH ANALYSIS (DRY)		% C							28.33
		% H							0.24
		% O (by diff.)							0.18
		% N							0.27
		% S							1.09
		% CaO							
		% Ash							69.89
		TOTAL MASS LOADING, gr/DNCM		14.319			19.003		
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S28a	S29	S29a	S30	S31	S31a	S32
		LOAD, MW	30.7	30.7	30.3	30.2	30.1	30.6	31.4
		SR_B	0.87	0.88	0.89	0.89	0.90	0.88	0.85
		SR_T	1.25	1.25	1.26	1.27	1.27	1.25	1.21
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	64	66	65	64	62	62	66
		T_{sec}, °C	304	313	313	307	307	304	302
		T_{tert}, °C	236	246	247	232	231	229	227
		V_{pri}, m/s	20.3	20.7	20.8	20.9	20.6	20.6	20.0
		V_{sec}, m/s	29.2	29.9	30.2	29.4	29.7	29.5	29.4
		V_{tert},	27.6	27.6	27.2	26.6	26.5	26.9	26.3
FLUE GAS ANALYSIS		O_2, % (dry)	4.3	4.3	4.4	4.5	4.6	4.3	3.7
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.9	18.1	18.0	17.8	18.7	18.1	17.7
		CO, ppm (dry)	57	50	57	51	51	50	49
		NO_x, ppm (dry)	490	516	519	509	531	528	510
		SO_2, ppm (wet)	604	402	380	586	295	302	583
		wet chem SO_2, ppm					328		
		wet chem SO_3, ppm					0.05		
SORBENT		SORBENT TYPE		Vicron	Vicron		Vicron	Vicron	
		INJECTION LOCATION*		OT	OT		OT	OT	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		2.63	2.63		5.33	5.33	
		Ca/S		1.42	1.43		2.93	2.88	
		% SO_2 CAPTURED		33.4	35.1		49.7	48.5	
		FLUE GAS TEMPERATURE, °C	938	938	938	966	943	927	
FLYASH ANALYSIS (DRY)		% C					7.39		
		% H					0.18		
		% O (by diff.)							
		% N					0.25		
		% S					1.57		
		% CaO							
		% Ash					75.52		
		TOTAL MASS LOADING, gr/DNCM					17.338		
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S33	S34	S34a	S35	S36	S37	S37a
		LOAD, MW	31.5	30.8	30.4	31.4	32.7	31.1	31.1
		SR_B	0.85	0.87	0.87	0.84	0.87	0.88	0.88
		SR_T	1.21	1.23	1.24	1.20	1.22	1.23	1.23
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	66	66	64	68	71	72	72
		T_{sec}, °C	301	303	314	303	312	376	313
		T_{tert}, °C	227	229	237	233	234	309	236
		V_{pri}, m/s	20.0	19.8	20.1	20.1	20.2	20.4	20.4
		V_{sec}, m/s	29.2	29.4	29.6	29.2	30.6	34.0	30.7
		V_{tert}, m/s	26.5	26.2	26.5	26.5	26.1	29.5	26.0
FLUE GAS ANALYSIS		O_2, % (dry)	3.7	4.0	4.1	3.6	3.8	4.0	4.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.2	17.8	17.9	18.1	17.8	18.0	17.8
		CO, ppm (dry)	49	49	50	48	49	49	49
		NO_x, ppm (dry)	498	494	460	495	525	531	531
		SO_2, ppm (wet)	437	568	559	386	611	445	425
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE	$CaCO_3$			$CaCO_3$		$Ca(OH)_2$	$Ca(OH)_2$
		INJECTION LOCATION*	OT			OT		OT	OT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	2.69			5.23		1.37	1.37
		Ca/S	1.42			2.77		0.97	0.98
		% SO_2 CAPTURED	25.0			36.8		27.2	30.4
		FLUE GAS TEMPERATURE, °C	978		953	968	964		986
FLYASH ANALYSIS (DRY)		% C				21.51			
		% H				0.57			
		% O (by diff.)				1.44			
		% N				0.26			
		% S				1.58			
		% CaO							
		% Ash				74.64			
		TOTAL MASS LOADING, gr/DNCM				17.234			
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

FLAME NR.			S38	S38a	S39	S39a	S40	S41	S41a
LOAD, MW			32.1	21.1	29.7	30.3	30.9	29.9	30.5
SR_B			0.85	0.89	0.92	0.91	0.89	0.92	0.90
SR_T			1.19	1.23	1.28	1.27	1.24	1.28	1.25
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			71	74	76	74	74	73	74
T_{sec}, °C			311	317	378	316	314	318	318
T_{tert}, °C			234	241	311	237	236	241	241
V_{pri}, m/s			20.4	21.3	21.3	20.8	20.8	21.0	20.2
V_{sec}, m/s			30.9	31.2	33.6	30.9	30.8	31.1	31.1
V_{tert}, m/s			25.9	25.9	29.5	25.9	26.3	26.1	26.1
FLUE GAS ANALYSIS		O_2, % (dry)	3.5	4.1	4.7	4.5	4.2	4.7	4.3
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.3	17.1	17.3	17.3	17.3	17.0	17.4
		CO, ppm (dry)	48	50	52	51	50	52	50
		NO_x, ppm (dry)	516	528	554	547	525	554	541
		SO_2, ppm (wet)	584	631	258	255	583	168	342
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT	SORBENT TYPE				$Ca(OH)_2$	$Ca(OH)_2$		$Ca(OH)_2$	Vicron
	INJECTION LOCATION*				OT	OT		OT	OT
	INJECTION VELOCITY, m/s								
	$\dot{M}_{sorb}$, kg/min				2.69	2.69		5.34	5.33
	Ca/S				2.01	1.97		3.95	2.89
% SO_2 CAPTURED					59.1	59.6		71.2	41.3
FLUE GAS TEMPERATURE, °C			943	947		954	954		943
FLYASH ANALYSIS (DRY)	% C								
	% H								
	% O (by diff.)								
	% N								
	% S								
	% CaO								
	% Ash								
TOTAL MASS LOADING, gr/DNCM					16.259				
FURNACE RETENTION, %									
COMMENTS									

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S42	S42a	S43	S42b	S43a	S44	S44a
		LOAD, MW	30.5	30.3	29.5	30.1	29.6	30.2	30.5
		SR_B	0.89	0.89	0.90	0.90	0.90	0.89	0.88
		SR_T	1.27	1.26	1.25	1.26	1.27	1.26	1.24
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	67	68	68	69	68	69	69
		T_{sec}, °C	279	287	290	317	314	311	317
		T_{tert}, °C	222	225	227	249	247	245	238
		V_{pri}, m/s	19.9	19.8	18.7	20.2	19.5	20.2	20.4
		V_{sec}, m/s	29.9	30.1	29.9	31.0	30.8	31.1	30.9
		V_{tert}, m/s	26.3	25.6	24.4	26.5	26.5	26.8	26.8
FLUE GAS ANALYSIS		O_2, % (dry)	4.5	4.4	4.3	4.4	4.5	4.4	4.2
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.6	17.7	17.8	18.0	17.8	17.8	17.8
		CO, ppm (dry)	57	63	50	51	51	51	50
		NO_x, ppm (dry)	503	506	540	506	560	531	525
		SO_2, ppm (wet)	598	633	428	658	484	595	625
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE			Vicron		Vicron		
		INJECTION LOCATION*			Mill		Mill		
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min			2.63		2.63		
		Ca/S			1.47		1.47		
		% SO_2 CAPTURED			32.4		26.4		
		FLUE GAS TEMPERATURE, °C		942	937	938	943	--	--
FLYASH ANALYSIS (DRY)		% C	23.75						
		% H	0.38						
		% O (by diff.)	0.83						
		% N	0.28						
		% S	1.32						
		% CaO	10.1						
		% Ash	73.44						
		TOTAL MASS LOADING, gr/DNCM	10.613						
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

			S45	S46	S46a	S47	S48	S49	S50
FLAME NR.			S45	S46	S46a	S47	S48	S49	S50
LOAD, MW			30.2	29.3	28.9	28.9	28.5	28.9	30.1
SR_B			0.88	0.91	0.91	0.91	0.92	0.91	0.88
SR_T			1.24	1.28	1.29	1.29	1.30	1.28	1.24
SWIRL SETTING			4	4	4	4	4	4	4
T_{pri}, °C			68	66	66	65	64	63	66
T_{sec}, °C			317	316	318	313	315	319	321
T_{tert}, °C			249	243	239	238	244	320	241
V_{pri}, m/s			19.4	18.6	18.9	18.7	18.7	18.2	18.1
V_{sec}, m/s			30.8	31.2	30.8	30.7	30.9	30.8	31.1
V_{tert}, m/s			26.6	26.2	26.0	26.2	26.2	30.0	26.3
FLUE GAS ANALYSIS		O_2, % (dry)	4.2	4.7	4.8	4.8	4.9	4.7	4.2
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.0	18.6	18.7	18.7	18.9	18.9	18.4
		CO, ppm (dry)	44	52	52	52	52	45	50
		NO_x, ppm (dry)	588	670	544	583	548	606	525
		SO_2, ppm (wet)	345	580	596	441	600	348	700
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT	SORBENT TYPE		Vicron			$CaCO_3$		$CaCO_3$	
	INJECTION LOCATION*		Mill			Mill		Mill	
	INJECTION VELOCITY, m/s								
	$\dot{M}_{sorb}$, kg/min		5.33			2.69		5.23	
	Ca/S		2.92			1.54		2.99	
% SO_2 CAPTURED			44.8			26.0		42.0	
FLUE GAS TEMPERATURE, °C			1018	952		964	944		
FLYASH ANALYSIS (DRY)	% C		19.17 7.57				16.8		
	% H		0.19 0.30				0.17		
	% O (by diff.)		0.0 1.7				0.0		
	% N		0.19 0.05				0.14		
	% S		1.19 1.96				1.66		
	% CaO								
	% Ash		79.45 88.42				82.71		
TOTAL MASS LOADING, gr/DNCM			16.623						
FURNACE RETENTION, %									
COMMENTS			Hi Vol IFRF						

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S51	S52	S53	S54	S54a	S55	S56
		LOAD, MW	30.3	29.5	30.2	28.4	28.2	30.3	29.5
		SR_B	0.84	0.90	0.87	1.19	1.21	1.12	1.16
		SR_T	1.20	1.27	1.23	1.24	1.27	1.18	1.22
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	68	68	68	65	64	66	66
		T_{sec}, °C	310	314	319	281	271	299	311
		T_{tert}, °C	237	239	248	135	131	138	146
		V_{pri}, m/s	17.8	19.4	18.7	19.7	19.8	19.4	19.1
		V_{sec}, m/s	29.4	30.7	30.9	52.2	38.6	40.1	41.6
		V_{tert}, m/s	26.1	26.1	26.4	3.0	3.1	3.0	3.3
FLUE GAS ANALYSIS		O_2, % (dry)	3.6	4.6	4.0	4.2	4.6	3.2	3.8
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.6	18.7	18.5	18.8	19.0	18.6	18.6
		CO, ppm (dry)	36	45	43	63	51	41	43
		NO_x, ppm (dry)	555	551	618	513	512	543	562
		SO_2, ppm (wet)	519	666	469	725	666	578	623
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE	$Ca(OH)_2$		$Ca(OH)_2$			$Ca(OH)_2$	
		INJECTION LOCATION*	Mill		Mill			Mill	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	1.97		4.01			1.97	
		Ca/S	1.44		2.95			1.46	
		% SO_2 CAPTURED	25.9		29.6			13.2	
		FLUE GAS TEMPERATURE, °C	976		1004				
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S57	S58	S59	S60	S60a	S61	S77
		LOAD, MW	30.7	29.9	28.7	29.7	30.2	30.2	30.7
		SR_B	1.10	1.18	1.22	1.19	1.18	1.17	1.17
		SR_T	1.15	1.26	1.30	1.27	1.27	1.25	1.24
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	66	62	63	66	69	71	72
		T_{sec}, °C	316	295	308	314	327	336	331
		T_{tert}, °C	142	143	153	164	180	181	183
		V_{pri}, m/s	17.9	19.6	19.6	19.4	19.9	19.9	19.5
		V_{sec}, m/s	41.5	43.3	42.9	44.1	44.8	44.6	44.9
		V_{tert}, m/s	3.1	4.7	4.8	4.9	5.2	5.2	5.1
FLUE GAS ANALYSIS		O_2, % (dry)	2.8	4.5	5.0	4.6	4.5	4.3	4.2
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.5	18.3	18.6	18.4	18.3	18.9	18.3
		CO, ppm (dry)	40	45	46	38	38	38	50
		NO_x, ppm (dry)	571	547	582	595	611	629	600
		SO_2, ppm (wet)	485	611	471	640	624	428	600
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE	$Ca(OH)_2$		Vicron			Vicron	
		INJECTION LOCATION*	Mill		OT			OT	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	4.01		2.63			5.32	
		Ca/S	2.91		1.52			2.92	
		% SO_2 CAPTURED	22.2		22.9			31.4	
		FLUE GAS TEMPERATURE, °C		927	940			974	957
FLYASH ANALYSIS (DRY)		% C		27.81		27.62			
		% H		0.30		0.28			
		% O (by diff.)		1.01		0.50			
		% N		0.31		0.31			
		% S		1.31		1.18			
		% CaO							
		% Ash		69.26		70.11			
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S62	S63	S64	S65	S66	S67	S68
		LOAD, MW	14.6	15.2	14.8	14.4	14.8	14.6	14.5
		SR_B	1.20	1.25	1.27	1.27	1.20	1.20	1.20
		SR_T	1.35	1.39	1.42	1.42	1.35	1.35	1.35
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	84	81	81	81	82	83	83
		T_{sec}, °C	331	292	287	308	349	362	383
		T_{tert}, °C	164	148	146	146	166	178	185
		V_{pri}, m/s	22.4	22.9	21.5	21.2	20.6	20.8	20.5
		V_{sec}, m/s	18.5	18.9	19.1	19.4	20.0	19.8	20.4
		V_{tert}, m/s	4.3	4.1	4.3	4.1	4.3	4.4	4.5
FLUE GAS ANALYSIS		O_2, % (dry)	5.5	6.0	6.3	6.3	5.5	5.5	5.5
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.6	17.9	17.7	17.7	17.6	17.6	17.6
		CO, ppm (dry)	271	154	343	271	203	190	176
		NO_x, ppm (dry)	325	308	314	336	339	352	352
		SO_2, ppm (wet)	677	392	686	286	623	407	650
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		Vicron		Vicron		$CaCO_3$	
		INJECTION LOCATION*		OT		OT		OT	
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		1.28		2.63		1.41	
		Ca/S		1.39		3.01		1.61	
		% SO_2 CAPTURED		42.1		58.3		34.7	
		FLUE GAS TEMPERATURE, °C	846	842		842	741	856	863
FLYASH ANALYSIS (DRY)		% C	37.90 38.83						
		% H	0.69 0.34						
		% O (by diff.)	6.22 7.82						
		% N	0.48 0.42						
		% S	1.95 0.60						
		% CaO							
		% Ash	52.76 56.94						
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS	Hi Vol IFRF						

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S69	S70	S71	S72	S73	S74	S75
		LOAD, MW	14.8	14.9	14.9	14.7	15.1	14.7	14.7
		SR_B	1.17	1.16	1.15	1.16	1.14	1.17	1.17
		SR_T	1.30	1.30	1.29	1.30	1.27	1.30	1.30
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	82	83	83	84	84	84	84
		T_{sec}, °C	382	383	389	387	403	406	411
		T_{tert}, °C	189	187	189	190	198	194	203
		V_{pri}, m/s	20.8	20.7	20.6	20.9	20.9	20.8	20.9
		V_{sec}, m/s	20.1	20.1	20.2	19.9	20.5	20.7	20.8
		V_{tert}, m/s	4.5	4.5	4.5	4.5	4.5	4.4	4.5
FLUE GAS ANALYSIS		O_2, % (dry)	5.0	4.9	4.8	4.9	4.6	5.0	5.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.6	17.5	17.6	17.5	17.4	17.5	17.9
		CO, ppm (dry)	184	209	207	170	141	158	172
		NO_x, ppm (dry)	361	359	363	365	378	368	400
		SO_2, ppm (wet)	315	600	363	600	269	630	131
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE	$CaCO_3$		$Ca(OH)_2$		$Ca(OH)_2$		$Ca(OH)_2$
		INJECTION LOCATION*	OT		OT		OT		OT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	2.69		0.88		1.37		2.69
		Ca/S	3.01		1.32		2.01		4.06
		% SO_2 CAPTURED	51.5		39.5		55.2		79.2
		FLUE GAS TEMPERATURE, °C	854		874	760	891		875
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S74a	S63a	S65	S74b	S85	S86	S86a
		LOAD, MW	14.3	14.6	14.3	14.8	31.1	31.1	30.7
		SR_B	1.20	1.18	1.15	1.15	0.83	0.86	0.87
		SR_T	1.35	1.31	1.30	1.29	1.27	1.29	1.30
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	85	85	84	86	72	71	71
		T_{sec}, °C	413	416	448	404	317	313	313
		T_{tert}, °C	206	207	272	203	248	242	242
		V_{pri}, m/s	20.9	20.8	20.7	21.1	22.7	22.9	22.9
		V_{sec}, m/s	20.9	20.9	20.6	20.5	29.5	30.5	30.5
		V_{tert}, m/s	4.6	4.5	5.5	4.5	32.7	32.2	32.2
FLUE GAS ANALYSIS		O_2, % (dry)	5.5	5.1	4.9	4.8	4.5	4.8	5.0
	CORRECTED TO 0% O_2	CO_2, % (dry)	17.3	17.4	17.6	17.4	18.1	18.5	18.4
		CO, ppm (dry)	163	132	130	130	50	53	53
		NO_x, ppm (dry)	393	396	391	389	477	549	532
		SO_2, ppm (wet)	596	383	196	544	675	421	394
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		Vicron	Vicron			Vicron	Vicron
		INJECTION LOCATION*		OT	OT			IT	IT
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		1.45	3.64			5.33	5.33
		Ca/S		1.64	4.21			2.84	2.87
		% SO_2 CAPTURED		35.7	67.1			37.6	41.6
		FLUE GAS TEMPERATURE, °C		886	893	891	978	967	967
FLYASH ANALYSIS (DRY)		% C						14.97	
		% H						0.28	
		% O (by diff.)						0.0	
		% N						0.15	
		% S						2.34	
		% CaO							
		% Ash						82.68	
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S78	S79	S80	S81	S82	S83	S84
		LOAD, MW	30.7	30.4	30.7	30.3	30.6	29.8	30.7
		SR_B	1.16	1.15	1.16	1.18	1.17	1.20	1.17
		SR_T	1.24	1.23	1.24	1.26	1.25	1.28	1.25
		SWIRL SETTING	4	4	4	4	4	4	4
		T_{pri}, °C	71	72	69	68	72	73	71
		T_{sec}, °C	336	341	337	316	314	320	312
		T_{tert}, °C	186	187	186	155	161	166	152
		V_{pri}, m/s	19.3	19.3	18.8	20.3	20.2	20.3	19.8
		V_{sec}, m/s	45.3	44.6	45.1	43.9	43.9	44.1	44.1
		V_{tert}, m/s	5.2	5.1	5.2	4.7	4.9	4.9	4.9
FLUE GAS ANALYSIS		O_2, % (dry)	4.2	4.0	4.1	4.4	4.3	4.7	4.3
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.5	18.5	18.6	18.5	18.6	18.6	18.6
		CO, ppm (dry)	44	49	45	51	44	45	44
		NO_x, ppm (dry)	638	618	671	595	622.5	606	673
		SO_2, ppm (wet)	500	568	373	620	465	618	352
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE	$CaCO_3$		$CaCO_3$		Vicron		Vicron
		INJECTION LOCATION*	Mill		Mill		Mill		Mill
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min	2.69		5.23		2.63		5.33
		Ca/S	1.45		2.83		1.42		2.87
		% SO_2 CAPTURED	16.7		34.3		25.0		43.0
		FLUE GAS TEMPERATURE, °C	962		959	938	939	938	964
FLYASH ANALYSIS (DRY)		% C							
		% H							
		% O (by diff.)							
		% N							
		% S							
		% CaO							
		% Ash							
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS							

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

SAAR COAL

		FLAME NR.	S87	S88	S89	S90	S91		
		LOAD, MW	30.7	31.2	31.9	29.9	29.9		
		SR_B	0.87	0.86	0.84	0.90	0.90		
		SR_T	1.30	1.29	1.27	1.35	1.35		
		SWIRL SETTING	4	4	4	4	4		
		T_{pri}, °C	70	72	72	74	74		
		T_{sec}, °C	314	311	308	314	314		
		T_{tert}, °C	246	241	242	242	242		
		V_{pri}, m/s	22.8	23.1	22.8	22.6	22.6		
		V_{sec}, m/s	30.4	30.4	30.4	30.8	30.8		
		V_{tert}, m/s	32.4	32.1	32.6	32.5	32.5		
FLUE GAS ANALYSIS		O_2, % (dry)	5.0	4.8	4.5	5.5	5.5		
	CORRECTED TO 0% O_2	CO_2, % (dry)	18.4	18.1	18.1	18.2	18.2		
		CO, ppm (dry)	54	52	54	54	54		
		NO_x, ppm (dry)	532	519	509	556	556		
		SO_2, ppm (wet)	656	389	662	244	407		
		wet chem SO_2, ppm							
		wet chem SO_3, ppm							
SORBENT		SORBENT TYPE		$Ca(OH)_2$		$Ca(OH)_2$	$Ca(OH)_2$		
		INJECTION LOCATION*		IT		IT	IT		
		INJECTION VELOCITY, m/s							
		$\dot{M}_{sorb}$, kg/min		2.69		5.34	1.37		
		Ca/S		1.92		3.96	1.01		
		% SO_2 CAPTURED		40.7		63.1	38.5		
		FLUE GAS TEMPERATURE, °C	991	1003		981	981		
FLYASH ANALYSIS (DRY)		% C		8.61 7.69		10.51 6.28			
		% H		0.18 0.17		0.20 0.13			
		% O (by diff.)		0.0 0.0		0.0 0.0			
		% N		0.08 0.04		0.10 0.02			
		% S		3.36 3.04		3.45 3.35			
		% CaO							
		% Ash		89.19 89.94		87.36 90.90			
		TOTAL MASS LOADING, gr/DNCM							
		FURNACE RETENTION, %							
		COMMENTS		Hi Vol Cyclone		Hi Vol Cyclone			

* Mill, IT = Inner Tertiary, OT = Outer Tertiary

APPENDIX D

PHASE II TEST DATA

This appendix includes all valid test data obtained during the second phase of the test program, optimization and evaluation of advanced design concepts for the Steinmüller SM burner (SM-II). The data presented are computer listings of the data with the headings at the top of the page describing the formatted numbers below. The formatting of the data was designed for use by the test engineer to present all data characterizing each test condition as completely as possible. This results in a very dense packing of information and much abbreviation. The following items, shown on the following page, explain some of the important data in the computer lists.

A) P.A. DES. - represents "primary air design." For this second phase, several devices designed for the primary air/coal nozzle were evaluated. These included the baseline (BL) annular nozzle arrangement; a venturi-shaped insert (VENTURI); and a splitter which produced a variable blockage, from 25 percent (25% BL) to a maximum of 50 percent blockage.

B) OIL CHECK - represents the standard procedure of closing an oxygen balance while firing a measured oil flow compared to the firing rate calculated based on oil composition, measured O_2 in the flue gas, and measured air flow with venturi flowmeters. The value of 8.3 for the data shown signifies that the O_2 balance was within 8.3 percent. The maximum deviation acceptable to continue testing is 10 percent. This procedure is described further in Appendix A.

C) Item C, "OIL, %, LOAD." is used only when oil is fired during startup. "OIL %" is the reading from a calibrated oil rotameter in percent of full scale. "OIL LOAD" is the firing rate calculated from the rotameter reading in 10^6 Btu/hr.

```
                                                                       A   TER DIA        :  10.0
DATE        :  01-30-84                                                 \  TER LOC        :  INNER
SYSTEM      :  LWS                                                       P.A.DES.         :  EL
BURNER      :  SSM-2                                                     OIL CHECK        :  8.3
FUEL        :  UTAH8              E                                   B-
                                  |
                LOAD    PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9   TOTAL   G    PRIM  CORE  SEC    TER      PRIM  CORE  SEC   TOTAL       O2    CO    CO2   NO     SO2
   PT0   TIME  MBTU/HR  TA                    FLOW SCFM                                 H        FLOW SCFM                     SR (CUM)           I            MEASURED            J
    OIL         CALC   SCFM D                 TEMP (F)  F                                         TEMP (F)                                                 CORR TO 0% O2
C (%)  LOAD     MEAS                                   E                                        VELOCITY (FT/SEC)                                          CORR TO 3% O2
                            D
   605 14:54:02  97.2 16257  2649  2913  4955  5163  2920   615   365   275   588  20443  G  H  2649   615  15952  1227      0.16  0.20  1.18  1.26  I     4.4   38.0  13.6  680.0   0.0 J
                                                                                                162   582    582   327                               0.0   48.1  17.2  860.2   0.0
C    0   0.0     94.7         691   675   686   676   677   505   619   572   627  F              61    21    168    14                               3.0   41.2  14.7  737.3   0.0
 K-TK(W=8300 LBS/HR     CORE=  90 DEG     SEC SWIRL SETTING= 0.00   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 6.30IN H2O    TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.30IN H2O    COAL P= 2.00IN H2O
 MILL IN=  540 F   MILL OUT= 168 F   EXIT= 1521 F   EXIT(sp)= 1568 F   SMPL= 1323 F   SEC WB= 582 F   TER WB= 327 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
 VALID DATA POINT 0   1   ELAPSED TIME, MIN  15   RECORD ON TRK   0   FILE   1   UNSTAGED-BASELINE
```

D) "TA SCFM" represents the theoretical air requirement in scfm for stoichiometric combustion for the calculated firing rate.

E) Item E lists the air flow in scfm through each venturi supplying the test burner. PRIM represents the primary air venturi. Venturis designated as V-2, V-3, V-4, and V-5 supply the burner windbox. The CORE venturi supplies the core air passage. Venturis V-7, V-8, and V-9 supply the tertiary air port windbox.

F) Item F lists the air temperatures in ^{o}F at the corresponding venturi flowmeters in E above.

G) Item G represents the "TOTAL" combustion air flow in scfm measured by the venturi flowmeters in Item E.

H) Item H calculates the air flow through each burner passage from the corresponding venturi flowmeters as described in Item E. Below H are listed the temperatures in ^{o}F and the actual air velocity in ft/sec for each burner passage.

I) Item I lists the stoichiometric ratio (SR) for each burner passage. These are listed cumulatively, which means that the fractional stoichiometric air from each passage is added to yield an overall stoichiometry for each zone.

J) Item J presents the emissions measured by the continuous monitors and include O_2, CO, CO_2, NO as NO_x, and SO_2. The top line lists the measured values on a dry basis. Below are values connected to both 0% O_2 and 3% O_2 for easy reference. During sorbent injection, SO_2 capture is calculated based on SO_2 emissions with and without sorbent injection as for the Phase I tests.

A final note for the data presented, during sorbent injection tests the configuration for injection through the tertiary air ports was slightly different than during Phase I. During this second phase, sorbent was injected only through the tertiary air ports through which tertiary air was flowing coaxially, whether the inner or outer ports were in use.

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DATE                  :      01-30-84                                    TER DIA          :     10.0
SYSTEM                :      LWS                                         TER LOC          :     INNER
BURNER                :      SSM-2                                       P.A.DES.         :     BL
FUEL                  :      UTAH8                                       OIL CHECK        :     8.3
______________________________________________________________________________________________________________________________________________________
             LOAD           PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL          PRIM  CORE  SEC    TER       PRIM  CORE  SEC  TOTAL        O2    CO    CO2   NO    SO2
PT#    TIME  MBTU/HR  TA                        'FLOW SCFM                                             FLOW SCFM                    SR (CUM)                          MEASURED
  OIL        CALC    SCFM                                                                               TEMP (F)                                                    CORR TO 0% O2
(%)    LOAD  MEAS                               TEMP (F)                                            VELOCITY (FT/SEC)                                              CORR TO 3% O2
______________________________________________________________________________________________________________________________________________________

605  14:54:02   97.2 16257  2649  2913  4955  5163  2920   615   365   275   588 20443          2649   615  15952  1227      0.16  0.20  1.18  1.26          4.4  38.0  13.6 600.0   0.0
                                                                                                162   582    582   327                                       0.0  48.1  17.2 860.2   0.0
  0     0.0     94.7         691   675   686   676   677   505   619   572   627                  61    21    168    14                                       3.0  41.2  14.7 737.3   0.0
K-TRON=H300 LBS/HR    CORE=  90 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.30IN H2O    TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.30IN H2O    COAL P= 2.00IN H2O
MILL IN=  548 F   MILL OUT= 168 F   EXIT= 1521 F   EXIT(sp)= 1568 F   SMPL= 1323 F   SEC WB= 582 F   TER WB= 327 F         SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  15   RECORD ON TRK   0   FILE   1   UNSTAGED-BASELINE
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THESE ARE
MASTERS

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DATE         :   01-31-84              TER DIA      :   1.0
SYSTEM       :   LWS                   TER LOC      :   INNER
BURNER       :   SSM-2   .             P.A.DES.     :   BL
FUEL         :   UTAH8                 OIL CHECK    :   S.S

                LOAD      PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL    PRIM  CORE   SEC    TER      PRIM  CORE   SEC  TOTAL      O2    CO   CO2    NO    SO2
PT#    TIME  MBTU/HR  TA                    FLOW SCFM                                      FLOW SCFM                   SR (CUM)                            MEASURED
  OIL         CALC  SCFM                                                                    TEMP (F)                                                     CORR TO 0% O2
(%)    LOAD   MEAS                          TEMP (F)                                     VELOCITY (FT/SEC)                                           CORR TO 3% O2

                                                                                                                                                4.1   40.0  14.2  620.0  490.0
357  14:00:21   99.4 16613  3077  3267  3893  4460  3914   812   344   304   450  20520   3077   812  15541  1099    0.19  0.23  1.17  1.24     0.0   49.7  17.6  770.4  608.9
                                                                                          157   580    580   326                               3.0   42.6  15.1  660.4  521.9
                                603   548   652   643   649   542   592   548   600        70    28    164    13
  0    0.0    98.1                                                                                 TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
K-TRON=8600 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.80IN H2O
MILL IN=  541 F   MILL OUT= 170 F   EXIT= 1481 F   EXIT(sp)= 1670 F   SMPL= 1275 F   SEC WB= 580 F   TER WB= 326 F   SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  20   RECORD ON TRK   0   FILE   2   UNSTAGED-SO2 TEST

                                                                                                                                                3.7   40.0  14.2  630.0  480.0
393  14:32:22  100.3 16773  3145  3375  3946  3980  3923   811   322   298   457  20250   3145   811  15225  1077    0.19  0.24  1.14  1.21     0.0   48.6  17.2  764.7  582.7
                                                                                          159   590    590   342                               3.0   41.6  14.0  655.5  499.1
                                599   645   651   641   645   560   593   553   599        72    20    162    13
  0    0.0    98.1                                                                                 TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
K-TRON=8600 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.80IN H2O
MILL IN=  543 F   MILL OUT= 164 F   EXIT= 1502 F   EXIT(sp)= 1656 F   SMPL= 1288 F   SEC WB= 590 F   TER WB= 342 F   SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE   3   EXCESS AIR CURVE

                                                                                                                                                2.9   44.0  14.8  610.0  520.0
413  14:42:06  101.7 17011  3147  3416  3635  3791  3751   813   334   302   469  19659   3147   813  14594  1105    0.18  0.23  1.09  1.16     0.0   51.0  17.2  707.7  603.3
                                                                                          161   602    602   350                               3.0   43.0  14.7  606.6  517.1
                                598   655   659   648   654   573   600   561   607        72    29    157    13
  0    0.0    98.1                                                                                 TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
K-TRON=8600 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.80IN H2O
MILL IN=  545 F   MILL OUT= 166 F   EXIT= 1497 F   EXIT(so)= 1553 F   SMPL= 1204 F   SEC WB= 602 F   TER WB= 350 F   SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE   4   EXCESS AIR CURVE

                                                                                                                                                4.0   37.0  13.4  670.0  450.0
465  15:07:20   99.4 16610  3114  4007  4020  4279  4120   776   312   282   411  21401   3114   776  16506  1005    0.19  0.23  1.23  1.29     0.0   48.0  17.4  868.5  583.3
                                                                                          162   596    596   345                               3.0   41.1  14.9  744.4  500.0
                                602   650   654   645   650   561   597   556   604        72    27    177    12
  0    0.0    97.0                                                                                 TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
K-TRON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.80IN H2O
MILL IN=  541 F   MILL OUT= 166 F   EXIT= 1502 F   EXIT(so)= 1453 F   SMPL= 1309 F   SEC WB= 596 F   TER WB= 345 F   SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE   5   EXCESS AIR CURVE

                                                                                                                                                4.1   35.0  14.0  670.0  500.0
552  15:43:37   99.8 16681  3038  4079  3702  3986  3964   785   317   303   439  20613   3038   785  15731  1058    0.18  0.23  1.17  1.24     0.0   43.5  17.4  832.5  621.3
                                                                                          163   602    602   345                               3.0   37.3  14.9  713.6  532.5
                                608   653   655   645   650   565   598   559   604        70    28    169    13
  0    0.0    97.0                                                                                 TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
K-TRON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.80IN H2O
MILL IN=  547 F   MILL OUT= 168 F   EXIT= 1494 F   EXIT(so)= 1450 F   SMPL= 1300 F   SEC WB= 602 F   TER WB= 345 F   SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN  15   RECORD ON TRK   0   FILE   6   UNSTAGED BASELINE-SO2 TEST

                                                                                                                                                5.4   32.0  13.0  670.0  440.0
552  15:43:37   96.8 16181  3198  4033  4066  4413  4150   774   307   282   400  21623   3038   785  15731  1058    0.19  0.30  1.27  1.34     0.0   43.1  17.5  901.9  592.3
                                                                                          163   602    602   345                               3.0   36.9  15.0  773.1  507.7
                                587   655   657   645   652   542   598   556   604        70    28    169    13
  0    0.0    97.0                                                                                 TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
K-TRON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 0.00   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.80IN H2O
MILL IN=  547 F   MILL OUT= 168 F   EXIT= 1494 F   EXIT(so)= 1450 F   SMPL= 1300 F   SEC WB= 602 F   TER WR= 345 F   SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN  15   RECORD ON TRK   0   FILE   7   EXCESS AIR CURVE
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DATE      :   02-02-84                                                      TER DIA     :   1.0
SYSTEM    :   LWS                                                           TER LOC     :   INNER
BURNER    :   SSM-2                                                         P.A.DES.    :   BL
FUEL      :   UTAH8                                                         OIL CHECK   :   8.37
---------------------------------------------------------------------------------------------------------------------------------------------------------------
               LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE   SEC   TER     PRIM  CORE  SEC  TOTAL    O2    CO   CO2    NO    SO2
PT#   TIME   MBTU/HR  TA                    FLOW SCFM                                              FLOW SCFM                   SR (CUM)                       MEASURED
 OIL          CALC   SCFM                                                                           TEMP (F)                                               CORR TO 0% O2
(%)   LOAD    MEAS                          TEMP (F)                                          VELOCITY (FT/SEC)                                           CORR TO 3% O2
---------------------------------------------------------------------------------------------------------------------------------------------------------------
362 10:44:15   96.2 16081  3150  4334  2620  4051  3894   126   472   520   618 20585     3150   126 15699  1611     0.20  0.20  1.10  1.20    4.7  42.0  13.6 580.0 460.0
                                                                                           166   584   584   327                              0.0  54.1  17.5 747.2 592.6
  0    0.0     97.0         627   655   651   646   650   316   508   552   590             73     4   166    19                              3.0  46.4  15.0 640.5 508.0
K-TRON=8500 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 4.80  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 6.30IN H2O   TER WINDBOX P= 0.00IN H2O   FURNACE P= 0.25IN H2O   COAL P= 2.00IN H2O
MILL IN=  533 F  MILL OUT= 173 F  EXIT= 1444 F  EXIT(sp)= 1610 F  SMPL= 1213 F  SEC WB= 584 F  TER WB= 327 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  1  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE  8  UNSTAGED-BASELINE

 77 11:27:41   98.8 16515  3263  3802  2687  3671  3281   126  1598  1317  1271 21015     3263   126 13441  4186     0.20  0.21  1.02  1.27    4.6  39.0  14.0 550.0 460.0
                                                                                           167   581   581   426                              0.0  49.9  17.9 704.3 589.0
  0    0.0     97.0         608   643   645   639   642   385   620   602   613             76     4   142    55                              3.0  42.8  15.4 603.7 504.9
K-TRON=8500 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 4.80  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 6.30IN H2O   TER WINDBOX P= 0.00IN H2O   FURNACE P= 0.25IN H2O   COAL P= 2.00IN H2O
MILL IN=  545 F  MILL OUT= 174 F  EXIT= 1450 F  EXIT(sp)= 1607 F  SMPL= 1222 F  SEC WB= 581 F  TER WB= 426 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  2  ELAPSED TIME, MIN  10  RECORD ON TRK  0  FILE  9  STAGING CURVE

125 11:55:33   98.7 16499  3237  3108  2547  3139  3072   119  2069  1805  1898 20995     3237   119 11866  5772     0.20  0.20  0.92  1.27    4.6  39.0  14.0 480.0 480.0
                                                                                           166   567   567   436                              0.0  49.9  17.9 614.6 614.6
  0    0.0     97.0         603   640   643   634   640   347   631   609   620             75     4   123    77                              3.0  42.8  15.4 526.8 526.8
K-TRON=8500 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 2.00  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 3.80IN H2O   TER WINDBOX P= 1.00IN H2O   FURNACE P= 0.25IN H2O   COAL P= 2.00IN H2O
MILL IN=  546 F  MILL OUT= 171 F  EXIT= 1448 F  EXIT(sp)= 1627 F  SMPL= 1217 F  SEC WB= 567 F  TER WB= 436 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  3  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE  10  STAGING CURVE

185 12:23:31  101.9 17035  3379  2546  2418  2577  2606   125  2569  2518  2557 21297     3379   125 10148  7644     0.20  0.21  0.80  1.25    4.3  44.0  14.2 360.0 480.0
                                                                                           165   558   558   444                              0.0  55.3  17.9 452.7 603.6
  0    0.0     97.0         524   643   650   638   646   316   640   623   632             78     4   105   102                              3.0  47.4  15.3 388.0 517.4
K-TRON=8500 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 2.00  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H2O   TER WINDBOX P= 1.90IN H2O   FURNACE P= 0.30IN H2O   COAL P= 2.00IN H2O
MILL IN=  516 F  MILL OUT= 166 F  EXIT= 1414 F  EXIT(sp)= 1567 F  SMPL= 1200 F  SEC WB= 558 F  TER WB= 444 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  4  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE  11  STAGING CURVE

207 12:33:46  101.0 16892  3210  2520  2373  2546  2584   129  2558  2519  2555 20994     3210   129 10024  7632     0.19  0.20  0.79  1.24    4.2  44.0  14.2 370.0 480.0
                                                                                           165   560   560   451                              0.0  55.0  17.8 462.5 600.0
  0    0.0     97.0         612   644   650   637   647   321   643   626   635             74     4   104   103                              3.0  47.1  15.2 396.4 514.5
K-TRON=8500 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 0.00  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H2O   TER WINDBOX P= 1.90IN H2O   FURNACE P= 0.30IN H2O   COAL P= 2.00IN H2O
MILL IN=  550 F  MILL OUT= 172 F  EXIT= 1446 F  EXIT(sp)= 1575 F  SMPL= 1209 F  SEC WB= 560 F  TER WB= 451 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  5  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE  12  REGISTER ADJUST.-MAX. SWIRL

387 14:06:40  101.5 16977  3236  2658  2405  2614  2769   127  2578  2572  2518 21475     3236   127 10445  7667     0.19  0.20  0.81  1.26    4.5  45.0  13.6 380.0 480.0
                                                                                           163   549   549   445                              0.0  57.3  17.3 483.6 610.9
  0    0.0     94.7         583   642   647   630   641   312   640   619   630             75     4   107   103                              3.0  49.1  14.8 414.5 523.6
K-TRON=8300 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 2.00  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H2O   TER WINDBOX P= 1.90IN H2O   FURNACE P= 0.30IN H2O   COAL P= 2.00IN H2O
MILL IN=  540 F  MILL OUT= 177 F  EXIT= 1446 F  EXIT(sp)= 1379 F  SMPL= 1205 F  SEC WB= 549 F  TER WB= 445 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  6  ELAPSED TIME, MIN  7  RECORD ON TRK  0  FILE  13  REPEAT-STAGED

409 14:24:20  101.7 17002  3200  2715  2394  2655  2751   124  2543  2587  2538 21506     3200   124 10514  7669     0.19  0.20  0.81  1.26    4.5  45.0  13.8 370.0 500.0
                                                                                           164   547   547   440                              0.0  57.3  17.6 470.9 636.4
  0    0.0     94.7         587   648   653   636   648   303   646   624   638             74     4   107   102                              3.0  49.1  15.1 403.6 545.5
K-TRON=8300 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 4.80  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H2O   TER WINDBOX P= 1.80IN H2O   FURNACE P= 0.35IN H2O   COAL P= 2.00IN H2O
MILL IN=  523 F  MILL OUT= 182 F  EXIT= 1433 F  EXIT(sp)= 1409 F  SMPL= 1214 F  SEC WB= 547 F  TER WB= 440 F      SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  7  ELAPSED TIME, MIN  7  RECORD ON TRK  0  FILE  14  REGISTER ADJUSTMENT
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DATE      :   02-02-84                                               TER DIA       :   1.0
SYSTEM    :   LWS                                                    TER LOC       :   INNER
BURNER    :   SSM-2                                                  P.A.DES.      :   BL
FUEL      :   UTAH8                                                  OIL CHECK     :
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             LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE   SEC   TER      PRIM  CORE   SEC  TOTAL      O2    CO    CO2    NO    SO2
PT#   TIME   MBTU/HR TA                         FLOW SCFM                                     FLOW SCFM                      SR (CUM)                              MEASURED
  OIL          CALC  SCFM                                                                      TEMP (F)                                                        CORR TO 0% O2
(%)   LOAD     MEAS                              TEMP (F)                                  VELOCITY (FT/SEC)                                                  CORR TO 3% O2
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441 14:30:33  101.4 16949  3277  2731  2382  2698  2773   125  2528  2545  2508 21567      3277   125 10584  7581      0.19  0.20  0.83  1.27      4.6  45.0  13.6 370.0 480.0
                                                                                           165   542   542   439                                  0.0  57.6  17.4 473.8 614.6
  0    0.0     94.7         571   650   654   638   649   304   648   625   639               76     4   107   101                                  3.0  49.4  14.9 406.1 526.8
K-TKON=8300 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 9.60  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.35IN H20    COAL P= 2.00IN H20
MILL IN=  521 F   MILL OUT= 176 F   EXIT= 1432 F   EXIT(sp)= 1414 F   SMPL= 1222 F   SEC WB= 542 F   TER WB= 439 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  8   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  15   REGISTER ADJUSTMENT

459 14:47:44   99.7 16667  3241  2614  2321  2569  2661   128  2510  2548  2490 21083      3241   128 10165  7549      0.19  0.20  0.81  1.26      4.5  45.0  13.6 360.0 470.0
                                                                                           164   545   545   443                                  0.0  57.3  17.3 458.2 598.2
  0    0.0     94.7         579   653   657   641   654   301   652   632   643               75     4   103   101                                  3.0  49.1  14.8 392.7 512.7
K-TKON=8300 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 14.0  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.35IN H20    COAL P= 2.00IN H20
MILL IN=  520 F   MILL OUT= 175 F   EXIT= 1458 F   EXIT(sp)= 1429 F   SMPL= 1235 F   SEC WB= 545 F   TER WB= 443 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  9   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  16   MMAX. REGISTER ADJUSTMENT

486 15:01:12  100.2 16753  3284  2585  2286  2575  2685   127  2505  2519  2502 21067      3284   127 10131  7525      0.20  0.20  0.81  1.26      4.4  40.0  13.8 360.0 480.0
                                                                                           164   552   552   451                                  0.0  50.6  17.5 455.4 607.2
  0    0.0     94.7         550   655   659   644   656   318   654   634   645               76     4   104   101                                  3.0  43.4  15.0 390.4 520.5
K-TKON=8300 LBS/HR    CORE=  0 DEG    SEC SWIRL SETTING= 12.0  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.35IN H20    COAL P= 2.00IN H20
MILL IN=  510 F   MILL OUT= 174 F   EXIT= 1446 F   EXIT(sp)= 1426 F   SMPL= 1229 F   SEC WB= 552 F   TER WB= 451 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  17   REGISTER ADJUSTMENT-LINKAGE STUCK

513 15:15:00  101.3 16930  3296  2470  2035  2300  2496  1019  2508  2542  2500 21165      3296  1019  9301  7550      0.19  0.25  0.80  1.25      4.3  45.0  13.8 325.0 460.0
                                                                                           165   552   552   453                                  0.0  56.6  17.4 408.7 603.6
  0    0.0     94.7         555   657   659   644   657   547   657   636   647               76    35    95   102                                  3.0  48.5  14.9 350.3 517.4
K-TRON=8300 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 12.0  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 1.70IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.35IN H20    COAL P= 2.00IN H20
MILL IN=  502 F   MILL OUT= 179 F   EXIT= 1464 F   EXIT(so)= 1415 F   SMPL= 1234 F   SEC WB= 552 F   TER WB= 453 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  18   CORE ADJUSTMENT

543 15:34:13   99.5 16641  3304  2417  1950  2278  2397  1094  2407  2446  2390 20683      3304  1094  9042  7243      0.20  0.26  0.81  1.24      4.2  45.0  14.0 320.0 480.0
                                                                                           165   560   560   462                                  0.0  56.3  17.5 400.0 600.0
  0    0.0     94.7         579   663   665   648   662   603   664   644   653               76    37    93    99                                  3.0  48.2  15.0 342.9 514.5
K-TKON=8300 LBS/HR    CORE= 90 DEG    SEC SWIRL SETTING= 10.0 ----  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 1.70IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.35IN H20    COAL P= 2.00IN H20
MILL IN=  517 F   MILL OUT= 182 F   EXIT= 1450 F   EXIT(so)= 1435 F   SMPL= 1229 F   SEC WB= 560 F   TER WB= 462 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  19   MAX. CORE
```

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DATE          :   02-06-84                               TER DIA       :   1.0
SYSTEM        :   LWS                                    TER LOC       :   INNER
BURNER        :   SSM-2                                  P.A.DES.      :   BL
FUEL          :   UTAH18                                 OIL CHECK     :   S.91

                  LOAD      PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL       O2   CO    CO2   NO    SO2
PT#    TIME     MBTU/HR  TA                      FLOW SCFM                                        FLOW SCFM                  SR (CUM)                         MEASURED
  OIL            CALC   SCFM                                                                      TEMP (F)                                                   CORR TO 0% O2
(%)    LOAD      MEAS                            TEMP (F)                                     VELOCITY (FT/SEC)                                             CORR TO 3% O2

259  09:53:45   99.2 16585  3337  4031  3706  3769  3886   909   326   260   631 20855      3337   909 15392  1217     0.20  0.26  1.18  1.26     4.4  50.0  15.2 585.0 460.0
                                                                                            164   599   599   337                                0.0  63.3  19.2 740.1 581.9
 0     0.0      94.7        546   659   656   646   655   573   595   553   604              77    32   165    14                                3.0  54.2  16.5 634.3 498.8
K-TRON=8300 LBS/HR    CORE= 45 DEG   SEC SWIRL SETTING= 2.40  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 6.40IN H2O   TER WINDBOX P= 0.30IN H2O   FURNACE P= 0.35IN H2O   COAL P= 1.00IN H2O
MILL IN=  497 F  MILL OUT= 171 F  EXIT= 1454 F  EXIT(sp)= 1620 F  SMPL= 1225 F  SEC WB= 599 F  TER WB= 337 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  1  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE 19  UNSTAGED-BASELINE

573  12:33:40   97.9 16362  3254  3423  2935  2959  3184   903  1358  1235  1446 20697      3254   903 12501  4039     0.20  0.25  1.02  1.26     4.5  40.0  14.0 520.0 480.0
                                                                                            162   599   599   462                                0.0  50.9  17.8 661.8 610.9
 0     0.0      94.7        576   682   681   669   678   547   664   638   653              75    32   134    55                                3.0  43.6  15.3 567.3 523.6
K-TRON=8300 LBS/HR    CORE= 45 DEG   SEC SWIRL SETTING= 2.40  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 4.00IN H2O   TER WINDBOX P= 1.60IN H2O   FURNACE P= 0.40IN H2O   COAL P= 2.10IN H2O
MILL IN=  526 F  MILL OUT= 171 F  EXIT= 1439 F  EXIT(sp)= 1632 F  SMPL= 1211 F  SEC WB= 599 F  TER WB= 462 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  2  ELAPSED TIME, MIN  7  RECORD ON TRK  0  FILE 20  STAGING CURVE

619  12:51:34   96.0 16059  3238  2996  1941  2347  2873   913  1638  2015  2115 20076      3238   913 10156  5768     0.20  0.26  0.89  1.25     4.3  40.0  14.4 410.0 480.0
                                                                                            163   602   602   494                                0.0  50.3  18.1 515.6 603.6
 0     0.0      97.0        565   683   684   671   682   561   671   656   664              75    32   109    81                                3.0  43.1  15.5 441.9 517.6
K-TRON=8500 LBS/HR    CORE= 45 DEG   SEC SWIRL SETTING= 2.40  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 3.00IN H2O   TER WINDBOX P= 1.40IN H2O   FURNACE P= 0.25IN H2O   COAL P= 2.00IN H2O
MILL IN=  503 F  MILL OUT= 170 F  EXIT= 1452 F  EXIT(sp)= 1640 F  SMPL= 1216 F  SEC WB= 602 F  TER WB= 494 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  3  ELAPSED TIME, MIN  9  RECORD ON TRK  0  FILE 21  STAGING CURVE

708  13:33:32  101.9 17041  3197  2929  1675  2398  2712   882  2180  2519  2566 21057      3197   882  9713  7265     0.19  0.24  0.81  1.24     4.1  40.0  14.4 370.0 460.0
                                                                                            161   593   593   505                                0.0  49.7  17.9 459.8 571.6
 0     0.0      95.8        567   677   676   662   675   549   669   652   663              73    31   104   104                                3.0  42.6  15.3 394.1 489.9
K-TRON=8400 LBS/HR    CORE= 45 DEG   SEC SWIRL SETTING= 2.40  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 2.60IN H2O   TER WINDBOX P= 1.80IN H2O   FURNACE P= 0.35IN H2O   COAL P= 2.00IN H2O
MILL IN=  518 F  MILL OUT= 167 F  EXIT= 1462 F  EXIT(sp)= 1523 F  SMPL= 1230 F  SEC WB= 593 F  TER WB= 505 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  4  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE 22  STAGING CURVE

733  13:49:13   99.5 16631  3177  2786  1788  2261  2709   897  2368  2489  2563 21037      3177   897  9545  7419     0.19  0.24  0.82  1.26     4.5  40.0  14.2 370.0 450.0
                                                                                            161   591   591   506                                0.0  50.9  18.1 470.9 572.7
 0     0.0      95.8        597   677   678   663   676   548   671   654   663              73    32   102   106                                3.0  43.6  15.5 403.6 490.9
K-TRON=8400 LBS/HR    CORE= 45 DEG   SEC SWIRL SETTING= 0.00  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 2.60IN H2O   TER WINDBOX P= 1.80IN H2O   FURNACE P= 0.35IN H2O   COAL P= 2.00IN H2O
MILL IN=  532 F  MILL OUT= 169 F  EXIT= 1460 F  EXIT(sp)= 1492 F  SMPL= 1227 F  SEC WB= 591 F  TER WB= 506 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  5  ELAPSED TIME, MIN  7  RECORD ON TRK  0  FILE 23  REGISTER ADJUSTMENT

746  13:56:24   98.9 16545  3181  2740  1943  2244  2755   168  2390  2543  2598 20563      3181   168  9682  7531     0.19  0.20  0.79  1.24     4.2  40.0  14.4 390.0 480.0
                                                                                            163   611   611   518                                0.0  50.0  18.0 487.5 600.0
 0     0.0      95.8        576   671   677   666   678   555   672   656   665              73     6   105   109                                3.0  42.9  15.4 417.9 514.5
K-TRON=8400 LBS/HR    CORE=  0 DEG   SEC SWIRL SETTING= 0.00  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 2.60IN H2O   TER WINDBOX P= 1.80IN H2O   FURNACE P= 0.35IN H2O   COAL P= 2.00IN H2O
MILL IN=  515 F  MILL OUT= 167 F  EXIT= 1469 F  EXIT(sp)= 1509 F  SMPL= 1226 F  SEC WB= 611 F  TER WB= 518 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  6  ELAPSED TIME, MIN  6  RECORD ON TRK  0  FILE 24  CORE ADJUSTMENT

772  14:09:58   99.0 16557  3242  2645  1901  2134  2620  1085  2385  2402  2408 20821      3242  1085  9300  7194     0.20  0.26  0.82  1.26     4.4  37.0  14.2 350.0 450.0
                                                                                            163   618   618   522                                0.0  46.8  18.0 442.8 569.3
 0     0.0      95.8        573   680   682   671   682   623   676   660   669              75    39   102   105                                3.0  40.1  15.4 379.5 488.0
K-TRON=8400 LBS/HR    CORE= 90 DEG   SEC SWIRL SETTING= 0.00  CM   SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 2.60IN H2O   TER WINDBOX P= 1.80IN H2O   FURNACE P= 0.35IN H2O   COAL P= 2.00IN H2O
MILL IN=  534 F  MILL OUT= 167 F  EXIT= 1468 F  EXIT(sp)= 1505 F  SMPL= 1219 F  SEC WB= 618 F  TER WB= 522 F       SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  7  ELAPSED TIME, MIN  6  RECORD ON TRK  0  FILE 25  CORE ADJUSTMENT
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DATE         :      02-06-84                              TER DIA      :     1.0
SYSTEM       :      LWS                                   TER LOC      :     INNER
BURNER       :      SSM-2                                 P.A.DES.     :     BL
FUEL         :      UTAH8                                 OIL CHECK    :     5.91

                LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE  SEC   TER     PRIM  CORE  SEC   TOTAL      O2    CO    CO2   NO    SO2
PT#    TIME   MBTU/HR  TA                  .      FLOW SCFM                                        FLOW SCFM                   SR (CUM)                         MEASURED
  OIL           CALC  SCFM                                                                          TEMP (F)                                                   CORR TO 0% O2
(%)    LOAD     MEAS                              TEMP (F)                                      VELOCITY (FT/SEC)                                          CORR TO 3% O2
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

811  14:26:05    99.1 16576  3207  2675  1899  2139  2654  1001  2377  2371  2398 20722        3207  1001  9357  7146     0.19  0.25  0.82  1.25       4.3   40.0  14.0 355.0 460.0
                                                                                                162   611   611   517                                  0.0   50.3  17.6 446.4 578.4
 0     0.0       95.8        618   687   689   677   687   591   682   664   673                 74    36   102   103                                  3.0   43.1  15.1 382.6 495.0
K-TRON=8400 LBS/HR      CORE=  45 DEG     SEC SWIRL SETTING= 4.80   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.60IN H20     TER WINDBOX P= 1.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  531 F   MILL OUT= 166 F   EXIT= 1453 F   EXIT(sp)= 1489 F   SMPL= 1224 F   SEC WB= 611 F   TER WB= 517 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  26   REGISTER ADJUSTMENT

833  14:39:12    99.1 16567  3167  2776  1981  2264  2726   140  2356  2394  2434 20238        3167   140  9747  7184     0.19  0.20  0.79  1.22       3.9   40.0  14.2 390.0 460.0
                                                                                                162   618   618   523                                  0.0   49.1  17.4 478.9 564.9
 0     0.0       95.8        571   690   693   681   690   427   685   668   676                 73     5   106   105                                  3.0   42.1  14.9 410.5 484.2
K-TRON=8400 LBS/HR      CORE=   0 DEG     SEC SWIRL SETTING= 4.80   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.60IN H20     TER WINDBOX P= 1.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  532 F   MILL OUT= 167 F   EXIT= 1469 F   EXIT(sp)= 1505 F   SMPL= 1233 F   SEC WB= 618 F   TER WB= 523 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   5   RECORD ON TRK   0   FILE  27   MIN. CORE

851  14:47:21    99.3 16607  3234  2688  1883  2235  2619  1091  2336  2377  2419 20883        3234  1091  9425  7133     0.19  0.26  0.83  1.26       4.4   40.0  13.8 360.0 440.0
                                                                                                162   619   619   524                                  0.0   50.6  17.5 455.4 556.6
 0     0.0       95.8        590   689   691   679   689   620   683   667   674                 74    39   103   104                                  3.0   43.4  15.0 390.4 477.1
K-TRON=8400 LBS/HR      CORE=  90 DEG     SEC SWIRL SETTING= 4.80   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.60IN H20     TER WINDBOX P= 1.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  552 F   MILL OUT= 168 F   EXIT= 1474 F   EXIT(sp)= 1510 F   SMPL= 1233 F   SEC WB= 619 F   TER WB= 524 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  28   CORE ADJUSTMENT

869  14:57:14    97.8 16350  3191  2649  1945  2137  2625   700  2355  2407  2429 20439        3191   700  9357  7191     0.20  0.24  0.81  1.25       4.3   40.0  14.0 365.0 450.0
                                                                                                162   616   616   523                                  0.0   50.3  17.6 459.0 565.9
 0     0.0       95.8        607   689   692   680   690   586   685   667   676                 73    25   102   105                                  3.0   43.1  15.1 393.4 485.0
K-TRON=8400 LBS/HR      CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.60IN H20     TER WINDBOX P= 1.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  555 F   MILL OUT= 166 F   EXIT= 1456 F   EXIT(sp)= 1488 F   SMPL= 1225 F   SEC WB= 616 F   TER WB= 523 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  29   BASELINE-STAGED

899  15:10:29    98.4 16459  3185  2720  1997  2224  2659   144  2391  2442  2448 20209        3185   144  9599  7281     0.19  0.20  0.79  1.23       4.0   40.0  14.2 385.0 460.0
                                                                                                162   620   620   525                                  0.0   49.4  17.5 475.3 567.9
 0     0.0       95.8        617   691   694   682   691   480   685   668   678                 73     5   105   106                                  3.0   42.3  15.0 407.4 486.8
K-TRON=8400 LBS/HR      CORE=   0 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.60IN H20     TER WINDBOX P= 1.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  557 F   MILL OUT= 167 F   EXIT= 1466 F   EXIT(sp)= 1505 F   SMPL= 1231 F   SEC WB= 620 F   TER WB= 525 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  30   CORE ADJUSTMENT

920  15:22:44    94.4 15786  3192  2332  1668  1951  2332  1102  2472  2489  2550 20088        3192  1102  8283  7511     0.20  0.27  0.80  1.27       4.6   37.0  13.6 350.0 440.0
                                                                                                161   605   605   519                                  0.0   47.4  17.4 448.2 563.4
 0     0.0       95.8        597   965   982   985   964   609   683   666   675                 73    39    89   109                                  3.0   40.6  14.9 384.1 482.9
K-TRON=8400 LBS/HR      CORE=  90 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.60IN H20     TER WINDBOX P= 1.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  531 F   MILL OUT= 168 F   EXIT= 1444 F   EXIT(sp)= 1483 F   SMPL= 1225 F   SEC WB= 605 F   TER WB= 519 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  13   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  31   CORE ADJUSTMENT

966  15:44:46    97.7 16343  3206  2581  2141  1950  2274   843  2450  2469  2517 20431        3206   843  8945  7436     0.20  0.25  0.80  1.25       4.3   37.0  13.8 345.0 440.0
                                                                                                162   614   614   522                                  0.0   46.5  17.4 433.8 553.3
 0     0.0       95.8        575   686   690   678   994   600   683   665   675                 74    30    97   108                                  3.0   39.9  14.9 371.9 474.3
K-TRON=8400 LBS/HR      CORE=  45 DEG     SEC SWIRL SETTING= 2.46   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.60IN H20     FURNACE P= 0.40IN H20     COAL P= 2.00IN H20
MILL IN=  519 F   MILL OUT= 171 F   EXIT= 1447 F   EXIT(sp)= 1489 F   SMPL= 1221 F   SEC WB= 614 F   TER WB= 522 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  14   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  32   OPTIMUM-STAGED
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DATE          :   02-06-84                                                  TER DIA        :   1.0
SYSTEM        :   LWS                                                       TER LOC        :   INNER
BURNER        :   SSM-2                                                     P.A.DES.       :   BL
FUEL          :   UTAH8                                                     OIL CHECK      :   5.91
-------------------------------------------------------------------------------------------------------------------------------------------------------------
                   LOAD            PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL     O2   CO    CO2   NO    SO2
PT#     TIME     MBTU/HR  TA                              FLOW SCFM                                       FLOW SCFM                  SR (CUM)                       MEASURED
  OIL              CALC   SCFM                                                                             TEMP (F)                                                 CORR TO 0% O2
(%)     LOAD       MEAS                                   TEMP (F)                                   VELOCITY (FT/SEC)                                              CORR TO 3% O2
-------------------------------------------------------------------------------------------------------------------------------------------------------------
---  15:57:59    99.6 16662  3238  2436  1753  1617  2206   839  2946  2993  3047 21076     3238   839  8013  8987     0.19  0.24  0.73  1.26     4.5  35.0  13.6  320.0  430.0
                                                                                             160   608   608   534                                0.0  44.5  17.3  407.3  547.3
 0      0.0      95.8           591   684   687   675   685   602   684   668   676            74    30    87   132                                3.0  38.2  14.8  349.1  469.1
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H2O    TER WINDBOX P= 2.60IN H2O    FURNACE P= 0.40IN H2O    COAL P= 2.00IN H2O
MILL IN=  544 F   MILL OUT= 163 F   EXIT= 1435 F   EXIT(sp)= 1477 F   SMPL= 1211 F   SEC WB= 608 F   TER WB= 534 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  15   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  33   STAGING  CURVE

---  16:14:37    99.0 16562  3241  2154  1297  1073  1905   839  3446  3427  3443 20826     3241   839  6430 10315     0.20  0.25  0.63  1.26     4.4  35.0  13.8  280.0  440.0
                                                                                             162   599   599   533                                0.0  44.3  17.5  354.2  556.6
 0      0.0      95.8           570   682   683   670   682   603   684   670   678            75    30    69   152                                3.0  38.0  15.0  303.6  477.1
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H2O    TER WINDBOX P= 2.60IN H2O    FURNACE P= 0.40IN H2O    COAL P= 2.00IN H2O
MILL IN=  523 F   MILL OUT= 167 F   EXIT= 1427 F   EXIT(sp)= 1473 F   SMPL= 1207 F   SEC WB= 599 F   TER WB= 533 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  16   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  34   STAGING CURVE

---  16:26:06    99.0 16546  3185  1928  1124   745  1699   839  3797  3711  3778 20806     3185   839  5496 11287     0.19  0.24  0.58  1.26     4.4  35.0  13.6  270.0  440.0
                                                                                             163   592   592   539                                0.0  44.3  17.2  341.6  556.6
 0      0.0      95.8           578   680   680   667   681   605   687   674   681            73    30    59   167                                3.0  38.0  14.7  292.8  477.1
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H2O    TER WINDBOX P= 2.60IN H2O    FURNACE P= 0.40IN H2O    COAL P= 2.00IN H2O
MILL IN=  522 F   MILL OUT= 174 F   EXIT= 1433 F   EXIT(sp)= 1475 F   SMPL= 1202 F   SEC WB= 592 F   TER WB= 539 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  17   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  35   MAXX. STAGING

---  16:41:05    99.5 16642  3248  2526  2102  2058  2562   832  2670  2684  2623 21303     3248   832  9247  7976     0.20  0.25  0.80  1.28     4.7  35.0  13.1  345.0  440.0
                                                                                             163   616   616   525                                0.0  45.1  16.9  444.5  566.9
 0      0.0      95.8           599   683   686   674   685   608   683   668   676            75    30   101   116                                3.0  38.7  14.5  381.0  485.0
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H2O    TER WINDBOX P= 2.60IN H2O    FURNACE P= 0.40IN H2O    COAL P= 2.00IN H2O
MILL IN=  515 F   MILL OUT= 169 F   EXIT= 1455 F   EXIT(sp)= 1498 F   SMPL= 1228 F   SEC WB= 616 F   TER WB= 525 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  18   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  36   OPTIMUN-BASELINE
```

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DATE        :   02-07-84                                    TER DIA       :   1.0
SYSTEM      :   LWS                                         TER LOC       :   INNER
BURNER      :   SSM-2                                       P.A.DES.      :   BL
FUEL        :   UTAH8                                       OIL CHECK     :   6.80
-------------------------------------------------------------------------------------------------------------------------------------------------------
               LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER      PRIM  CORE  SEC  TOTAL      O2   CO   CO2   NO   SO2
PT#    TIME  MBTU/HR  TA                       FLOW SCFM                                         FLOW SCFM                   SR (CUM)                          MEASURED
  OIL          CALC  SCFM                                                                         TEMP (F)                                                   CORR TO 0% O2
(%)   LOAD     MEAS                            TEMP (F)                                      VELOCITY (FT/SEC)                                               CORR TO 3% O2
-------------------------------------------------------------------------------------------------------------------------------------------------------

271  10:32:51   99.5 16644  3306  3862  4269  3396  4129   868   351   250   624 21054        3306   868 15655  1225      0.20  0.25  1.19  1.26       4.5  40.0  13.8 590.0 480.0
                                                                                             163   582   582   343                                 0.0  50.9  17.6 750.9 610.9
  0    0.0      95.8         596   646   645   636   641   548   577   537   587                76    30   165    15                                 3.0  43.6  15.1 643.6 523.6
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 6.40IN H20     TER WINDBOX P= 0.10IN H20     FURNACE P= 0.25IN H20     COAL P= 2.00IN H20
MILL IN=  545 F   MILL OUT= 173 F   EXIT= 1463 F   EXIT(sp)= 1627 F   SMPL= 1229 F   SEC WB= 582 F   TER WB= 343 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  37   BASELINE-UNSTAGED

302  10:53:13  100.9 16869  3316  3372  3149  2239  3714   864  1523  1510  1402 21089        3316   864 12474 . 4435      0.20  0.25  0.99  1.25       4.3  40.0  14.2 500.0 490.0
                                                                                             163   582   582   430                                 0.0  50.3  17.9 628.7 616.2
  0    0.0      95.8         579   639   641   628   638   562   618   598   609                76    30   132    58                                 3.0  43.1  15.3 538.9 528.1
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H20     TER WINDBOX P= 0.50IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  531 F   MILL OUT= 173 F   EXIT= 1482 F   EXIT(sp)= 1671 F . SMPL= 1233 F   SEC WB= 582 F   TER WB= 430 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  38   STAGING CURVE

324  11:02:14  102.4 17130  3332  3007  2621  2057  3237   859  2230  2234  2092 21669        3332   859 10922  6556      0.19  0.24  0.88  1.26       4.5  40.0  14.0 390.0 500.0
                                                                                             163   581   581   453                                 0.0  50.9  17.8 496.4 636.4
  0    0.0      95.8         572   638   641   628   639   563   628   612   618                77    30   115    89                                 3.0  43.6  15.3 425.5 545.5
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H20     TER WINDBOX P= 0.50IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  528 F   MILL OUT= 174 F   EXIT= 1445 F   EXIT(sp)=  217 F   SMPL= 1219 F   SEC WB= 581 F   TER WB= 453 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME. MIN   7   RECORD ON TRK   0   FILE  39   STAGING CURVE

374  11:26:50  102.5 17143  3300  2363  2372  2627  2751   856  2503  2512  2531 21815        3300   856 10112  7546      0.19  0.24  0.83  1.27       4.6  40.0  13.8 340.0 400.0
                                                                                             162   574   574   468                                 0.0  51.2  17.7 435.4 614.6
  0    0.0      94.7         576   640   645   634   644   558   638   623   630                76    30   106   104                                 3.0  43.9  15.1 373.2 526.8
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.30IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  529 F   MILL OUT= 171 F   EXIT= 1448 F   EXIT(sp)= 1638 F   SMPL= 1209 F   SEC WB= 574 F   TER WB= 468 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME. MIN   9   RECORD ON TRK   0   FILE  40   BASELINE-STAGED

396  11:37:54  101.8 17026  3310  2250  2094  2263  2602   870  2420  2278  2247 20334        3310   870  9209  6946      0.19  0.25  0.79  1.19       3.5  45.0  14.8 290.0 510.0
                                                                                             163   584   584   473                                 0.0  54.0  17.8 348.0 612.0
  0    0.0      94.7         556   650   653   643   651   573   646   630   638                76    30    97    96                                 3.0  46.3  15.2 298.3 524.6
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.30IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  505 F   MILL OUT= 178 F   EXIT= 1455 F   EXIT(sp)= 1639 F   SMPL= 1199 F   SEC WB= 584 F   TER WB= 473 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  41   EXCESS AIR CURVE

435  11:56:56   99.4 16619  3357  2257  1942  2048  2525   887  2014  1841  1637 18508        3357   887  8772  5492      0.20  0.26  0.78  1.11       2.2  55.0  15.8 275.0 560.0
                                                                                             164   615   615   484                                 0.0  61.4  17.6 307.2 625.5
  0    0.0      94.7         545   685   689   671   686   610   676   658   665                77    32    96    77                                 3.0  52.7  15.1 263.3 536.2
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.30IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  497 F   MILL OUT= 171 F   EXIT= 1471 F   EXIT(sp)= 1651 F   SMPL= 1197 F   SEC WB= 615 F   TER WB= 484 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  42   EXCESS AIR CURVE

446  12:04:49   99.9 16698  3349  2175  1975  2026  2529   891  1851  1680  1471 17946        3349   891  8705  5002      0.20  0.25  0.78  1.07       1.5  65.0  16.4 260.0 580.0
                                                                                             164   622   622   484                                 0.0  70.0  17.7 280.0 624.6
  0    0.0      94.7         558   700   703   690   699   612   692   669   677                77    32    95    70                                 3.0  60.0  15.1 240.0 535.4
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.30IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  512 F   MILL OUT= 166 F   EXIT= 1574 F   EXIT(sp)= 1723 F   SMPL= 1276 F   SEC WB= 622 F   TER WB= 464 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  43   MIN. EXCESS AIR
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DATE          :  02-07-84                                         TER DIA       :  1.0
SYSTEM        :  LWS                                              TER LOC       :  INNER
BURNER        :  SSM-2                                            P.A.DES.      :  BL
FUEL          :  UTAH8                                            OIL CHECK     :  6.80

                 LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC   TOTAL      02    CO    CO2   NO    SO2
PT#    TIME      MBTU/HR TA                           FLOW SCFM                                     FLOW SCFM                  SR (CUM)                          MEASURED
  OIL            CALC   SCFM                                                                         TEMP (F)                                                CORR TO 0% 02
(%)    LOAD      MEAS                                 TEMP (F)                                  VELOCITY (FT/SEC)                                            CORR TO 3% 02

474  12:18:23   102.8 17183   3311  2385  2431  2393  2464   841  2549  2522  2461 21356      3311   841  9673  7531     0.19  0.24  0.80  1.24       4.2  40.0  14.2  325.0  480.0
                                                                                                163   619   619   501                                  0.0  50.0  17.8  406.3  600.0
 0     0.0      94.7          568   697   702   689   697   587   692   674   683               76    30   106   107                                  3.0  42.9  15.2  348.2  514.3
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.30IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  522 F   MILL OUT= 166 F   EXIT= 1461 F   EXIT(sp)=  816 F   SMPL= 1210 F   SEC WB= 619 F   TER WB= 501 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  44   BASELINE

490  12:26:54   103.4 17282   3263  2383  2391  2412  2467   829  2665  2986  2861 22256      3263   829  9652  8511     0.19  0.24  0.80  1.29       4.8  40.0  13.8  330.0  470.0
                                                                                                167   597   597   502                                  0.0  51.9  17.9  427.8  609.3
 0     0.0      94.7          553   680   685   672   682   550   677   662   671               76    29   103   121                                  3.0  44.4  15.3  366.7  522.2
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.20IN H20     FURNACE P= 0.30IN H20     COAL P= 2.00IN H20
MILL IN=  505 F   MILL OUT= 170 F   EXIT= 1458 F   EXIT(sp)= 1662 F   SMPL= 1221 F   SEC WB= 597 F   TER WB= 502 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  45   EXCESS AIR CURVE

502  12:33:32   102.8 17185   3295  2435  2508  2546  2559   799  2413  3645  3508 23708      3295   799 10048  9566     0.19  0.24  0.82  1.38       5.9  40.0  12.8  355.0  420.0
                                                                                                166   592   592   500                                  0.0  55.6  17.8  493.7  584.1
 0     0.0      94.7          564   667   672   659   669   555   664   652   660               76    28   107   136                                  3.0  47.7  15.3  423.2  500.7
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.20IN H20     FURNACE P= 0.30IN H20     COAL P= 2.00IN H20
MILL IN=  515 F   MILL OUT= 174 F   EXIT= 1440 F   EXIT(sp)= 1628 F   SMPL= 1220 F   SEC WB= 592 F   TER WB= 500 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  46   MAX. EXCESS AIR

577  13:07:10   102.5 17134   3369  3577  4108  4196  3920   838   331   245   589 21172      3369   838 15801  1165     0.20  0.25  1.17  1.24       4.1  37.0  14.3  640.0  510.0
                                                                                                166   620   620   360                                  0.0  46.0  17.8  795.3  633.7
 0     0.0      94.7          557   682   685   674   682   563   623   578   631               78    30   173    14                                  3.0  39.4  15.2  681.7  543.2
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPRF^DER BLOCKAGE=   0.0 %     SEC WINDBOX P= 6.10IN H20     TER WINDBOX P= 0.10IN H20     FURNACE P= 0.25IN H20     COAL P= 2.00IN H20
MILL IN=  511 F   MILL OUT= 166 F   EXIT= 1490 F   EXIT(sp)= 1648 F   SMPL= 1250 F   SEC WB= 620 F   TER WB= 360 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  47   STAGING-OUTER TERTS

624  13:30:49   100.0 16724   3340  2972  3268  2977  3364   842  1654  1468  1146 21031      3340   842 12581  4268     0.20  0.25  1.00  1.26       4.4  40.0  14.0  505.0  480.0
                                                                                                165   600   600   450                                  0.0  50.6  17.7  638.9  607.2
 0     0.0      94.7          563   677   681   668   679   544   662   638   647               77    30   135    58                                  3.0  43.4  15.2  547.6  520.5
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 4.00IN H20     TER WINDBOX P= 0.70IN H20     FURNACE P= 0.25IN H20     COAL P= 2.00IN H20
MILL IN=  523 F   MILL OUT= 169 F   EXIT= 1479 F   EXIT(sp)=  146 F   SMPL= 1238 F   SEC WB= 600 F   TER WB= 450 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  48   STAGING-OUTER TERTS

656  13:45:22   100.0 16713   3343  2521  2675  2359  2912   838  2099  2144  2004 20893      3343   838 10467  6246     0.20  0.25  0.88  1.25       4.3  40.0  14.0  400.0  480.0
                                                                                                165   599   599   511                                  0.0  50.3  17.6  503.0  603.6
 0     0.0      94.7          559   680   686   672   684   560   673   656   663               77    30   112    90                                  3.0  43.1  15.1  431.1  517.4
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.25IN H20     COAL P= 2.00IN H20
MILL IN=  514 F   MILL OUT= 168 F   EXIT= 1485 F   EXIT(sp)= 1672 F   SMPL= 1222 F   SEC WB= 599 F   TER WB= 511 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  13   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  49   STAGING-OUTER TERTS

689  14:00:18   103.1 17243   3307  2299  2436  2317  2717   823  2478  2584  2470 21431      3307   823  9769  7532     0.19  0.24  0.81  1.24       4.2  40.0  14.2  335.0  500.0
                                                                                                164   594   594   526                                  0.0  50.0  17.8  418.8  625.0
 0     0.0      94.7          541   684   690   677   688   561   681   664   672               76    29   104   110                                  3.0  42.9  15.2  358.9  535.7
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 3.40IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  504 F   MILL OUT= 164 F   EXIT= 1491 F   EXIT(sp)= 1657 F   SMPL= 1223 F   SEC WB= 594 F   TER WB= 526 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  14   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  50   BASELINE-STAGED--OUTER TERTS
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DATE       :    02-07-84                        TER DIA        :    1.0
SYSTEM     :    LWS                             TER LOC        :    OUTER
BURNER     :    SSM-2                           P.A.DES.       :    BL
FUEL       :    UTAH8                           OIL CHECK      :    6.80

                LOAD           PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC   TOTAL       O2   CO    CO2   NO    SO2
PT#     TIME   MBTU/HR  TA                             FLOW SCFM                                    FLOW SCFM                   SR (CUM)                          MEASURED
   OIL          CALC   SCFM                                                                          TEMP (F)                                                  CORR TO 0% O2
(%)     LOAD    MEAS                                    TEMP (F)                                VELOCITY (FT/SEC)                                              CORR TO 3% O2

713  14:14:31   102.7 17173  3336  2181  1924  1870  2229   828  2532  3331  3238  21469     3336   828  8204  9100     0.19  0.24  0.72  1.25        4.3  45.0  14.0  275.0  480.0
                                                                                             164   580   580   535                                   0.0  56.6  17.6  345.8  603.6
                                                                                              77    29    86   134                                   3.0  48.5  15.1  296.4  517.4
 0     0.0      94.7          558   683   687   674   686   551   681   664   676
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  512 F   MILL OUT= 167 F   EXIT= 1487 F   EXIT(sp)= 1633 F   SMPL= 1225 F   SEC WB= 580 F   TER WB= 535 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  15   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  51   STAGING-OUTER TERTS

743  14:27:53   105.5 17648  3356  1692  1370  1487  1756   826  2111  4556  4653  21807     3356   826  6305  11320    0.19  0.24  0.59  1.24        4.1  48.0  14.4  215.0  500.0
                                                                                             165   574   574   550                                   0.0  59.6  17.9  267.2  621.3
                                                                                              78    29    66   169                                   3.0  51.1  15.3  229.0  532.5
 0     0.0      94.7          545   676   680   666   679   572   679   675   681
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  506 F   MILL OUT= 166 F   EXIT= 1523 F   EXIT(sp)= 1581 F   SMPL= 1209 F   SEC WB= 574 F   TER WB= 550 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  16   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  52   MAX. STAGING-OUTER TERTS

764  14:42:34   103.1 17234  3371  1350  1184  1165  1507   835  1819  5033  5282  21545     3371   835  5206  12134    0.20  0.24  0.55  1.25        4.3  55.0  13.8  210.0  480.0
                                                                                             165   556   556   554                                   0.0  69.2  17.4  264.1  603.6
                                                                                              78    28    54   182                                   3.0  59.3  14.9  226.3  517.4
 0     0.0      94.7          557   673   675   659   678   561   679   676   684
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  511 F   MILL OUT= 170 F   EXIT= 1546 F   EXIT(sp)= 1510 F   SMPL= 1233 F   SEC WB= 556 F   TER WB= 554 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  17   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  53   MAX. STAGING-OUTER TERTS

813  15:02:35    99.4 16623  3415  2355  2303  2030  2661   835  1991  2766  2426  20781     3415   835  9348  7183     0.21  0.26  0.82  1.25        4.3  35.0  14.0  335.0  500.0
                                                                                             165   597   597   521                                   0.0  44.0  17.6  421.3  628.7
                                                                                              79    30   100   104                                   3.0  37.7  15.1  361.1  538.9
 0     0.0      94.7          529   683   686   672   689   552   679   666   674
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  493 F   MILL OUT= 167 F   EXIT= 1491 F   EXIT(sp)= 1451 F   SMPL= 1217 F   SEC WB= 597 F   TER WB= 521 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  18   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  54   STAGED-BASELINE--OUTER TERTS

833  15:12:59    99.2 16589  3364  2351  2083  1738  2587   855  1868  2358  2070  19275     3364   855  8759  6296     0.20  0.25  0.78  1.16        3.0  45.0  15.0  285.0  560.0
                                                                                             164   607   607   526                                   0.0  52.5  17.5  332.5  653.3
                                                                                              78    31    95    92                                   3.0  45.0  15.0  285.0  560.1
 0     0.0      93.5          553   692   693   679   696   586   685   671   681
K-TRON=8200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  504 F   MILL OUT= 168 F   EXIT= 1507 F   EXIT(sp)= 1467 F   SMPL= 1207 F   SEC WB= 607 F   TER WB= 526 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  19   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  55   EXCESS AIR-OUTER TERTS

862  15:28:48    96.7 16176  3435  2276  1984  1669  2527   867  1666  1753  1383  17560     3435   867  8456  4802     0.21  0.27  0.79  1.09        1.7  50.0  16.0  300.0  600.0
                                                                                             165   637   637   530                                   0.0  54.4  17.4  326.4  652.8
                                                                                              79    32    94    70                                   3.0  46.6  14.9  279.8  559.b
 0     0.0      93.5          554   721   721   706   723   629   712   691   697
K-TRON=8200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  505 F   MILL OUT= 172 F   EXIT= 1510 F   EXIT(sp)= 1501 F   SMPL= 1205 F   SEC WB= 637 F   TER WB= 530 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  20   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  56   MIN. EXCESS AIR

883  15:42:19   103.7 17347  3333  2396  2327  2247  2633   795  2485  3218  3180  22614     3333   795  9603  8883     0.19  0.24  0.79  1.30        5.0  38.0  13.4  330.0  480.0
                                                                                             165   630   630   560                                   0.0  49.9  17.6  433.1  630.0
                                                                                              77    29   106   134                                   3.0  42.8  15.1  371.3  540.0
 0     0.0      93.5          561   702   706   695   706   615   701   688   695
K-TRON=8200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O     TER WINDBOX P= 3.40IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  517 F   MILL OUT= 174 F   EXIT= 1480 F   EXIT(sp)= 1456 F   SMPL= 1235 F   SEC WB= 630 F   TER WB= 560 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  21   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  57   EXCESS AIR CURVE-OUTER TERTS
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DATE        :   02-07-84                                     TER DIA        :   1.0
SYSTEM      :   LWS                                          TER LOC        :   OUTER
BURNER      :   SSM-2                                        P.A.DES.       :   BL
FUEL        :   UTAH8                                        OIL CHECK      :   6.80
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              LOAD         PRIM   V -2   V -3   V -4   V -5   CORE   V -7   V -8   V -9   TOTAL        PRIM   CORE   SEC    TER        PRIM   CORE   SEC   TOTAL       O2    CO    CO2    NO     SO2
PT#    TIME   MBTU/HR  TA                        FLOW SCFM                                                   FLOW SCFM                        SR (CUM)                            MEASURED
  OIL         CALC   SCFM                                                                                     TEMP (F)                                                          CORR TO 0% O2
(%)    LOAD   MEAS                               TEMP (F)                                                VELOCITY (FT/SEC)                                                      CORR TO 3% O2
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

897  15:47:55  103.3  17268  3309   2387   2301   2262   2634    776   2145   3934   3921  23669        3309    776   9583  10000       0.19   0.24   0.79   1.37       5.0   35.0   12.6  345.0  460.0
                                                                                                       166    616    616    554                                          0.0   48.4   17.4  476.6  635.5
 0     0.0     93.5           593    683    688    679    689    602    682    673    681               77     28    105    150                                          3.0   41.4   14.9  408.6  544.7
K-TRON=8200 LBS/HR      CORE=  45 DEG      SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 3.40IN H2O    FURNACE P= 0.35IN H2O    COAL P= 2.00IN H2O
MILL IN=  838 F   MILL OUT= 450 F   EXIT= 1553 F   EXIT(sp)= 1519 F   SMPL= 1235 F   SEC WB= 616 F   TER WB= 554 F            SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  22   ELAPSED TIME, MIN   5   RECORD ON TRK   0   FILE  58   EXCESS AIR-MAX.-OUTER TERTS

---  16:46:45   50.6   8459  3164   1534   1413   1527   1757    487    212    121    359  10575        3164    487   6231    693       0.37   0.43   1.17   1.25       4.3   45.0   13.8  315.0  480.0
                                                                                                       156    647    647    343                                          0.0   56.6   17.4  396.1  603.6
 0     0.0     52.5           375    743    745    723    739    610    646    595    659               72     18     70      8                                          3.0   48.5   14.9  339.5  517.4
K-TRON=4600 LBS/HR      CORE=  45 DEG      SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.00IN H2O    TER WINDBOX P= 0.10IN H2O    FURNACE P= 0.01IN H2O    COAL P= 1.30IN H2O
MILL IN=  349 F   MILL OUT= 156 F   EXIT= 1255 F   EXIT(sp)= 1235 F   SMPL=  961 F   SEC WB= 647 F   TER WB= 343 F            SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  23   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  59   LOW LOAD-UNSTAGED

---  17:00:43   52.5   8776  3138   1284   1197   1222   1531    447    962    851    601  11234        3138    447   5234   2415       0.36   0.41   1.00   1.28       4.7   52.0   13.4  290.0  480.0
                                                                                                       155    653    653    422                                          0.0   67.0   17.3  373.6  610.4
 0     0.0     52.5           389    757    764    738    756    618    729    690    695               71     17     59     32                                          3.0   57.4   14.8  320.2  530.1
K-TRON=4600 LBS/HR      CORE=  45 DEG      SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.00IN H2O    TER WINDBOX P= 0.10IN H2O    FURNACE P= 0.01IN H2O    COAL P= 1.30IN H2O
MILL IN=  356 F   MILL OUT= 157 F   EXIT= 1269 F   EXIT(sp)= 1253 F   SMPL=  974 F   SEC WB= 653 F   TER WB= 422 F            SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  24   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  60   STAGING-LOW LOAD
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DATE          :   02-09-84                              TER DIA       :   1.0
SYSTEM        :   LWS                                   TER LOC       :   INNER
BURNER        :   SSM-2                                 P.A.DES.      :   BL
FUEL          :   INDIANA4                              OIL CHECK     :   4.05
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              LOAD            PRIM   V -2   V -3   V -4   V -5  CORE   V -7   V -8   V -9  TOTAL      PRIM  CORE   SEC   TER        PRIM  CORE   SEC  TOTAL       O2    CD    CO2    NO    SO2
PT#    TIME   MBTU/HR  TA                             FLOW SCFM                                          FLOW SCFM                     SR (CUM)                           MEASURED
  OIL          CALC   SCFM                                                                                TEMP (F)                                                      CORR TO 0% O2
(%)    LOAD    MEAS                                  TEMP (F)                                        VELOCITY (FT/SEC)                                                  CORR TO 3% O2
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 54  09:49:57   100.9 16955  3320   3553   3762   3617   3955   911   1035   597    481 21231      3320   911 14887  2113       0.20  0.25  1.13  1.25       4.3   42.0   15.0 555.0  860.0
                                                                                                   139   590   590   393                                    0.0   52.8   18.9 697.9 1081.4
  0     0.0     94.7          621    634    629    625    632   565    614    579    593            74    32   158    27                                    3.0   45.3   16.2 598.2  926.9
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.40IN H2O    TER WINDBOX P= 0.00IN H2O    FURNACE P= 0.35IN H2O    COAL P= 2.00IN H2O
MILL IN=  577 F   MILL OUT= 135 F   EXIT= 1507 F   EXIT(sp)= 1704 F   SMPL= 1261 F   SEC WB= 590 F   TER WB= 393 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  12   RECORD ON TRK    0   FILE  61   UNSTAGED

359  12:29:05   102.2 17167  3323   3716   4056   3957   3895   925    490    504    631 21497      3323   925 15624  1625       0.19  0.25  1.16  1.25       4.3   52.0   15.0 490.0  880.0
                                                                                                   139   578   578   344                                    0.0   65.4   18.9 616.2 1106.6
  0     0.0     92.6          687    649    641    632    643   526    580    545    587            74    32   164    19                                    3.0   56.0   16.2 528.1  948.5
K-TRON=8800 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.00IN H2O    TER WINDBOX P= 0.10IN H2O    FURNACE P= 0.40IN H2O    COAL P= 2.00IN H2O
MILL IN=  632 F   MILL OUT= 131 F   EXIT= 1474 F   EXIT(sp)= 1641 F   SMPL= 1238 F   SEC WB= 578 F   TER WB= 344 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN  10   RECORD ON TRK    0   FILE  62   UNSTAGED

407  12:54:02   100.8 16938  3300   3128   3050   3009   3198   936   1270   1436   1517 20842      3300   936 12384  4222       0.19  0.25  0.98  1.23       4.0   40.0   15.4 500.0  920.0
                                                                                                   142   559   559   411                                    0.0   49.4   19.0 617.6 1136.5
  0     0.0     93.7          690    640    632    622    636   520    619    596    610            73    32   128    54                                    3.0   42.4   16.3 529.4  974.1
K-TRON=8900 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 4.00IN H2O    TER WINDBOX P= 1.20IN H2O    FURNACE P= 0.25IN H2O    COAL P= 2.00IN H2O
MILL IN=  638 F   MILL OUT= 123 F   EXIT= 1511 F   EXIT(sp)= 1706 F   SMPL= 1278 F   SEC WB= 559 F   TER WB= 411 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   7   RECORD ON TRK    0   FILE  63   STAGING CURVE

486  13:34:16    98.9 16621  3302   2666   2768   2500   2638   940   2032   1967   2121 20936      3302   940 10573  6120       0.20  0.26  0.89  1.26       4.4   40.0   14.8 435.0  880.0
                                                                                                   143   576   576   456                                    0.0   50.6   18.7 550.3 1113.3
  0     0.0     93.7          736    660    649    640    655   551    651    630    642            74    33   111    83                                    3.0   43.4   16.0 471.7  954.2
K-TRON=8900 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.70IN H2O    TER WINDBOX P= 1.10IN H2O    FURNACE P= 0.30IN H2O    COAL P= 1.70IN H2O
MILL IN=  673 F   MILL OUT= 143 F   EXIT= 1489 F   EXIT(sp)= 1680 F   SMPL= 1266 F   SEC WB= 576 F   TER WB= 456 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   8   RECORD ON TRK    0   FILE  64   STAGING CURVE

520  13:52:31   101.3 17012  3264   2551   2555   2194   2425   941   2506   2459   2408 21302      3264   941  9725  7372       0.19  0.25  0.82  1.25       4.3   42.0   15.0 400.0  920.0
                                                                                                   145   566   566   467                                    0.0   52.8   18.9 503.0 1156.9
  0     0.0     94.7          741    655    645    635    651   547    649    634    641            73    32   101   101                                    3.0   45.3   16.2 431.1  991.6
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  678 F   MILL OUT= 145 F   EXIT= 1488 F   EXIT(sp)= 1662 F   SMPL= 1256 F   SEC WB= 566 F   TER WB= 467 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   8   RECORD ON TRK    0   FILE  65   BASELINE-STAGED

569  14:16:39    99.4 16697  3255   2086   1387   1810   1994  1063   2997   3029   2926 20545      3255  1063  7276  8951       0.19  0.26  0.69  1.23       4.0   40.0   15.2 325.0  900.0
                                                                                                   145   553   553   479                                    0.0   49.4   18.8 401.5 1111.8
  0     0.0     94.7          741    655    645    633    652   561    656    643    649            73    36    75   125                                    3.0   42.4   16.1 344.1  952.9
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  679 F   MILL OUT= 143 F   EXIT= 1453 F   EXIT(sp)= 1627 F   SMPL= 1228 F   SEC WB= 553 F   TER WB= 479 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   7   RECORD ON TRK    0   FILE  66   STAGING CURVE

602  14:34:00    99.6 16735  3292   1788   1092   1406   1594  1048   3643   3633   3585 21080      3292  1048  5879 10861       0.20  0.26  0.61  1.26       4.4   38.0   14.7 320.0  860.0
                                                                                                   147   536   536   494                                    0.0   48.1   18.6 404.8 1088.0
  0     0.0     94.7          744    654    643    629    650   559    660    648    652            74    35    59   153                                    3.0   41.2   15.9 347.0  932.5
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  681 F   MILL OUT= 133 F   EXIT= 1441 F   EXIT(sp)= 1614 F   SMPL= 1229 F   SEC WB= 536 F   TER WB= 494 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   7   RECORD ON TRK    0   FILE  67   MAX. STAGING
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DATE          :   02-09-84                          TER DIA      :   1.0
SYSTEM        :   LWS                               TER LOC      :   INNER
BURNER        :   SSM-2                             P.A.DES.     :   BL
FUEL          :   INDIANA4                          OIL CHECK    :   4.05
---------------------------------------------------------------------------------------------------------------------------------------------------------
                 LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL     O2    CO    CO2    NO    SO2
PT#    TIME   MBTU/HR  TA                      FLOW SCFM                                          FLOW SCFM                     SR (CUM)                          MEASURED
  OIL           CALC  SCFM                                                                         TEMP (F)                                                     CORR TO 0% O2
(%)    LOAD     MEAS                           TEMP (F)                                        VELOCITY (FT/SEC)                                                CORR TO 3% O2
---------------------------------------------------------------------------------------------------------------------------------------------------------

647  14:54:26   98.7 16576  3266  2061  2431  1941  2309  1045  2592  2645  2346  20635     3266  1045  8741  7583     0.20  0.26  0.79  1.24     4.2   40.0  15.0  385.0  900.0
                                                                                             146   565   565   471                                0.0   50.0  18.8  481.3 1125.0
  0     0.0     95.8         747   649   648   630   650   561   649   634   641               73    36    91   105                                3.0   42.9  16.1  412.5  964.3
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  686 F   MILL OUT= 140 F   EXIT= 1501 F   EXIT(sp)= 1685 F   SMPL= 1261 F   SEC WB= 565 F   TER WB= 471 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  68   BASELINE-STAGED

666  15:04:52   97.2 16331  3234  2091  2384  1948  2335  1057  2245  2136  1775  19206     3234  1057  8759  6156     0.20  0.26  0.80  1.18     3.2   45.0  16.0  395.0  960.0
                                                                                             147   588   588   470                                0.0   53.1  18.9  466.0 1132.6
  0     0.0     95.8         747   658   656   640   661   590   658   642   649               73    37    93    85                                3.0   45.5  16.2  399.4  970.8
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  689 F   MILL OUT= 137 F   EXIT= 1531 F   EXIT(sp)= 1715 F   SMPL= 1270 F   SEC WB= 588 F   TER WB= 470 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  69   EXCESS AIR CURVE

697  15:19:17   97.6 16402  3283  2093  2417  1929  2293  1069  1904  1790  1315  18093     3283  1069  8732  5009     0.20  0.27  0.80  1.10     2.0   55.0  17.2  375.0 1090.0
                                                                                             147   620   620   484                                0.0   60.8  19.0  414.5 1204.7
  0     0.0     95.8         739   687   682   664   685   628   681   662   669               74    39    96    70                                3.0   52.1  16.3  355.3 1032.6
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  687 F   MILL OUT= 136 F   EXIT= 1536 F   EXIT(sp)= 1715 F   SMPL= 1267 F   SEC WB= 620 F   TER WB= 484 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  70   MIN. EXCESS AIR

723  15:32:01   99.0 16632  3198  2153  2453  2245  2267   975  2932  3063  2847  22131     3198   975  9117  8841     0.19  0.25  0.80  1.33     5.3   40.0  13.8  420.0  880.0
                                                                                             147   602   602   501                                0.0   53.5  18.5  561.8 1177.1
  0     0.0     95.8         755   680   680   665   681   592   681   668   677               72    35    98   126                                3.0   45.9  15.8  481.5 1008.9
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  692 F   MILL OUT= 145 F   EXIT= 1480 F   EXIT(sp)= 1653 F   SMPL= 1267 F   SEC WB= 602 F   TER WB= 501 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  71   EXCESS AIR CURVE

742  15:44:20  101.0 16971  3100  2109  2476  2247  2254   943  3580  3667  3401  23777     3100   943  9086 10648     0.18  0.24  0.77  1.40     6.1   37.0  12.8  425.0  800.0
                                                                                             147   571   571   492                                0.0   52.1  18.0  599.0 1127.5
  0     0.0     95.8         769   639   641   630   642   558   643   633   644               70    33    95   150                                3.0   44.7  15.5  513.4  966.4
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  701 F   MILL OUT= 127 F   EXIT= 1464 F   EXIT(sp)= 1642 F   SMPL= 1256 F   SEC WB= 571 F   TER WB= 492 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  72   MAX. EXCESS AIR

808  15:59:10   99.1 16656  3196  2192  2528  2194  2282  1026  2354  2557  2285  20613     3196  1026  9195  7196     0.19  0.25  0.81  1.24     4.1   40.0  15.0  395.0  920.0
                                                                                             146   566   566   465                                0.0   49.7  18.6  490.8 1143.2
  0     0.0     95.8         751   646   644   632   645   558   644   631   641               72    35    96    99                                3.0   42.6  16.0  420.7  979.9
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.80IN H2O    TER WINDBOX P= 0.30IN H2O    FURNACE P= 0.25IN H2O    COAL P= 1.70IN H2O
MILL IN=  691 F   MILL OUT= 138 F   EXIT= 1502 F   EXIT(sp)= 1694 F   SMPL= 1263 F   SEC WB= 566 F   TER WB= 465 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  13   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  73   BASELINE-STAGED
```

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DATE          :    02-10-84                         TER DIA       :    10
SYSTEM        :    LWS                              TER LOC       :    INNER
BURNER        :    SSM-2                            P.A.DES.      :    BL
FUEL          :    UTAH8                            OIL CHECK     :    1.48
-------------------------------------------------------------------------------------------------------------------------------------------------------
               LOAD     PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER      PRIM  CORE   SEC  TOTAL        O2    CO   CO2    NO   SO2
PT#    TIME  MBTU/HR  TA                    FLOW SCFM                                        FLOW SCFM                      SR (CUM)                             MEASURED
  OIL          CALC  SCFM                                                                    TEMP (F)                                                          CORR TO 0% O2
(%)    LOAD    MEAS                         TEMP (F)                                     VELOCITY (FT/SEC)                                                     CORR TO 3% O2
-------------------------------------------------------------------------------------------------------------------------------------------------------

203  09:49:19  102.4 17119  3321  3464  4636  3993  3851   984   262   277   613 21401 .     3321   984 15944  1152      0.19  0.25  1.18  1.25        4.3  37.0  14.4 595.0 580.0
                                                                                           170   545   545   325                                     0.0  46.5  18.1 748.2 729.3
  0     0.0    91.3          682   615   607   596   608   503   537   512   557              77    33   162    13                                     3.0  39.9  15.5 641.3 625.1
K-TRON=0000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.60IN H2O    TER WINDBOX P= 0.10IN H2O    FURNACE P= 1.80IN H2O    COAL P= 1.80IN H2O
MILL IN=  627 F   MILL OUT= 185 F   EXIT= 1510 F   EXIT(sp)= 1681 F   SMPL= 1287 F   SEC WB= 545 F   TER WB= 325 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  74   UTAH-UNSTAGED-REPEAT POINT
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```
DATE          :   02-10-84                       TER DIA        :   1.0
SYSTEM        :   LWS                            TER LOC        :   INNER
BURNER        :   SSM-2                          P.A.DES.       :   BL
FUEL          :   SAAR2                          OIL CHECK      :   1.48
------------------------------------------------------------------------------------------------------------------------------------------------------------
              LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC   TOTAL       O2   CO    CO2   NO    SO2
PT#   TIME    MBTU/HR  TA                        FLOW SCFM                                        FLOW SCFM                     SR (CUM)                             MEASURED
  OIL         CALC    SCFM                                                                        TEMP (F)                                                     CORR TO 0% O2
(%)   LOAD    MEAS                               TEMP (F)                                    VELOCITY (FT/SEC)                                                 CORR TO 3% O2
------------------------------------------------------------------------------------------------------------------------------------------------------------

272  10:23:11   101.0  17033  3526  3469  4565  3924  3727   954   256   277   600  21300       3526   954 15686  1133     0.21  0.26  1.18  1.25        4.3  55.0  15.0  480.0  540.0
                                                                                                 167   599   599   358                                    0.0  69.2  18.9  603.6  679.0
  0     0.0     103.5          469   651   647   639   648   574   584   554   600                82    34   168    14                                    3.0  59.3  16.2  517.4  582.0
K-TRON=7900 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 5.60IN H2O     TER WINDBOX P= 0.10IN H2O     FURNACE P= 0.20IN H2O     COAL P= 1.80IN H2O
MILL IN=  442 F   MILL OUT= 171 F   EXIT= 1511 F   EXIT(sp)= 1637 F   SMPL= 1280 F   SEC WB= 599 F   TER WB= 358 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  75   BASELINE-STAGED

336  10:52:34   101.2  17058  3459  3081  3261  2690  3100   989  1605  1532  1616  21332       3459   989 12131  4753     0.20  0.26  0.97  1.25        4.3  55.0  15.0  425.0  560.0
                                                                                                 164   561   561   429                                    0.0  69.2  18.9  534.4  704.2
  0     0.0     102.1          503   638   632   622   635   532   622   602   612                80    34   126    63                                    3.0  59.3  16.2  458.1  603.6
K-TRON=7800 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 3.10IN H2O     TER WINDBOX P= 0.35IN H2O     FURNACE P= 0.30IN H2O     COAL P= 2.00IN H2O
MILL IN=  464 F   MILL OUT= 168 F   EXIT= 1489 F   EXIT(sp)= 1591 F   SMPL= 1270 F   SEC WB= 561 F   TER WB= 429 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  76   STAGING CURVE

358  11:03:25   103.1  17388  3477  2861  3018  2545  2916   968  1864  2057  2166  21872       3477   968 11340  6087     0.20  0.26  0.91  1.26        4.4  55.0  14.8  385.0  540.0
                                                                                                 166   574   574   448                                    0.0  69.6  18.7  487.0  683.1
  0     0.0     102.1          454   643   639   629   643   555   633   615   626                80    34   119    82                                    3.0  59.6  16.0  417.5  585.5
K-TRON=7800 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.40IN H2O     TER WINDBOX P= 1.30IN H2O     FURNACE P= 0.25IN H2O     COAL P= 1.80IN H2O
MILL IN=  424 F   MILL OUT= 169 F   EXIT= 1500 F   EXIT(sp)= 1578 F   SMPL= 1276 F   SEC WB= 574 F   TER WB= 448 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  77   STAGING CURVE

388  11:15:30   107.1  18056  3376  2660  2739  2384  2664   961  2449  2576  2771  22579       3376   961 10447  7795     0.19  0.24  0.82  1.25        4.3  55.0  14.8  340.0  560.0
                                                                                                 164   563   563   463                                    0.0  69.2  18.6  427.5  704.2
  0     0.0     102.1          502   638   635   625   638   541   632   618   626                78    33   108   107                                    3.0  59.3  16.0  366.5  603.6
K-TRON=7800 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.60IN H2O     TER WINDBOX P= 1.90IN H2O     FURNACE P= 0.20IN H2O     COAL P= 1.90IN H2O
MILL IN=  445 F   MILL OUT= 167 F   EXIT= 1516 F   EXIT(sp)= 1585 F   SMPL= 1280 F   SEC WB= 563 F   TER WB= 463 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  78   BASELINE-STAGED

423  11:41:55   105.9  17862  3472  2094  2121  2018  2067   961  3070  3275  3390  22469       3472   961  8300  9735     0.19  0.25  0.71  1.26        4.4  50.0  14.8  290.0  540.0
                                                                                                 165   556   556   482                                    0.0  63.3  18.7  366.9  683.1
  0     0.0     100.8          464   633   631   623   635   565   635   623   632                80    33    85   136                                    3.0  54.2  16.0  314.5  585.5
K-TRCN=7700 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.60IN H2O     TER WINDBOX P= 1.90IN H2O     FURNACE P= 0.20IN H2O     COAL P= 1.90IN H2O
MILL IN=  414 F   MILL OUT= 169 F   EXIT= 1457 F   EXIT(sp)= 1529 F   SMPL= 1252 F   SEC WB= 556 F   TER WB= 482 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  79   STAGING CURVE

453  11:55:32   107.3  18089  3464  1749  1735  1436  1587   961  3795  3861  3900  22489       3464   961  6507 11557     0.19  0.24  0.60  1.24        4.2  50.0  15.2  275.0  520.0
                                                                                                 166   553   553   495                                    0.0  62.5  19.0  343.8  650.0
  0     0.0     100.8          470   636   631   621   634   582   644   631   641                80    33    67   163                                    3.0  53.6  16.3  294.6  557.1
K-TRON=7700 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.60IN H2O     TER WINDBOX P= 1.90IN H2O     FURNACE P= 0.20IN H2O     COAL P= 1.90IN H2O
MILL IN=  442 F   MILL OUT= 168 F   EXIT= 1455 F   EXIT(sp)= 1615 F   SMPL= 1260 F   SEC WB= 553 F   TER WB= 495 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  80   MAX. STAGED

504  12:19:40   101.2  17057  3503  2410  2189  2260  2451   974  2421  2768  2481  21456       3503   974  9310  7670     0.21  0.26  0.81  1.26        4.4  50.0  14.6  335.0  550.0
                                                                                                 164   571   571   470                                    0.0  63.3  18.5  423.8  695.8
  0     0.0     100.8          489   643   639   631   642   569   640   626   635                81    34    97   166                                    3.0  54.2  15.8  363.3  596.4
K-TRON=7700 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.60IN H2O     TER WINDBOX P= 1.90IN H2O     FURNACE P= 0.20IN H2O     COAL P= 1.90IN H2O
MILL IN=  444 F   MILL OUT= 171 F   EXIT= 1403 F   EXIT(sp)= 1649 F   SMPL= 1259 F   SEC WB= 571 F   TER WB= 470 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  81   BASELINE-STAGED
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DATE                   :     02-10-84                         TER DIA          :     10
SYSTEM                 :     LWS                              TER LOC          :     INNER
BURNER                 :     SSM-2                            P.A.DES.         :     BL
FUEL                   :     SAAR2                            OIL CHECK        :     1.48

                 LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER        PRIM  CORE  SEC  TOTAL      O2   CO    CO2   NO    SO2
PT#    TIME   MBTU/HR  TA                           FLOW SCFM                                      FLOW SCFM                      SR (CUM)                         MEASURED
  OIL             CALC SCFM                                                                         TEMP (F)                                                     CORR TO 0% O2
(%)    LOAD       MEAS                              TEMP (F)                                     VELOCITY (FT/SEC)                                               CORR TO 3% O2

520  12:28:21   101.0 17029  3505  2345  2277  2264  2408   992  2148  2229  1951  20119      3505   992  9294  6327       0.21  0.26  0.81  1.18       3.3  52.0  15.8  320.0  630.0
                                                                                               164   581   581   469                                   0.0  61.7  18.7  379.7  747.5
  0     0.0     100.8         408   657   652   644   656   577   652   635   642               81    35    98    87                                   3.0  52.9  16.1  325.4  640.7
K-TRON=7700 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 1.60IN H20    TER WINDBOX P= 1.90IN H20    FURNACE P= 0.20IN H20    COAL P= 1.90IN H20
MILL IN=  449 F   MILL OUT= 170 F   EXIT= 1505 F   EXIT(sp)= 1660 F   SMPL= 1254 F   SEC WB= 581 F   TER WB= 469 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  9   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  82   EXCESS AIR CURVE

540  12:39:02   100.8 17000  3491  2352  2296  2235  2357  1019  1558  1695  1454  18457      3491  1019  9240  4707       0.21  0.27  0.81  1.09       1.7  62.0  17.6  305.0  700.0
                                                                                               163   587   587   456                                   0.0  67.5  19.2  331.9  761.7
  0     0.0     100.8         404   685   677   666   681   580   674   650   659               81    36    98    64                                   3.0  57.8  16.4  284.5  652.0
K-TRON=7700 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 1.60IN H20    TER WINDBOX P= 1.90IN H20    FURNACE P= 0.20IN H20    COAL P= 1.90IN H20
MILL IN=  439 F   MILL OUT= 169 F   EXIT= 1549 F   EXIT(sp)= 1670 F   SMPL= 1256 F   SEC WB= 587 F   TER WB= 456 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10  ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  83   MIN. EXCESS AIR

561  12:50:32   102.8 17343  3399  2402  2383  2503  2568   914  2666  3213  2848  22896      3399   914  9855  8727       0.20  0.25  0.82  1.32       5.2  50.0  13.6  365.0  540.0
                                                                                               164   598   598   501                                   0.0  66.5  18.1  485.1  717.7
  0     0.0     100.8         479   684   680   672   684   582   681   664   673               78    32   106   124                                   3.0  57.0  15.5  415.8  615.2
K-TRON=7700 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.25IN H20    COAL P= 2.20IN H20
MILL IN=  433 F   MILL OUT= 169 F   EXIT= 1503 F   EXIT(sp)= 1593 F   SMPL= 1285 F   SEC WB= 598 F   TER WB= 501 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11  ELAPSED TIME, MIN   6 . RECORD ON TRK   0   FILE  84   EXCESS AIR CURVE

573  12:58:16   103.4 17435  3373  2321  2341  2442  2520   894  3163  3674  3320  24063      3373   894  9632 10165       0.19  0.24  0.80  1.30       5.9  45.0  13.2  365.0  500.0
                                                                                               164 - 581   581   499                                   0.0  62.6  18.4  507.6  695.4
  0     0.0     100.8         403   659   657   650   661   567   658   647   654               78    31   102   144                                   3.0  53.6  15.7  435.1  596.0
K-TRON=7700 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.25IN H20    COAL P= 2.20IN H20
MILL IN=  451 F   MILL OUT= 160 F   EXIT= 1459 F   EXIT(sp)= 1556 F   SMPL= 1271 F   SEC WB= 581 F   TER WB= 499 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12  ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  85   MAX. EXCESS AIR

592  13:07:24   103.9 17516  3428  2501  2503  2382  2552   948  2486  2797  2308  21904      3428   948  9938  7591       0.20  0.25  0.82  1.25       4.3  50.0  14.8  340.0  560.0
                                                                                               164   580   580   470                                   0.0  62.9  18.6  427.5  704.2
  0     0.0  .  100.8         400   648   644   638   649   574   645   631   641               79    33   105   105                                   3.0  53.9  16.0  366.5  603.6
K-TRON=7700 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.25IN H20    COAL P= 2.20IN H20
MILL IN=  439 F   MILL OUT= 173 F   EXIT= 1511 F   EXIT(sp)= 1601 F   SMPL= 1273 F   SEC WB= 580 F   TER WB= 478 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  13  ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  86   BASELINE-STAGED
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DATE          :     02-13-84                                  TER DIA          :     8.0
SYSTEM        :     LWS                                       TER LOC.         :     INNER
BURNER        :     SSM-2                                     P.A.DES.         :     BL
FUEL          :     UTAH8                                     OIL CHECK        :     6.51
----------------------------------------------------------------------------------------------------------------------------------------------------
             LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL        O2    CO    CO2   NO    SO2
PT#   TIME   MBTU/HR TA                          FLOW SCFM                                         FLOW SCFM                  SR (CUM)                              MEASURED
  OIL        CALC   SCFM                                                                           TEMP (F)                                                     CORR TO 0% O2
(%)   LOAD   MEAS                                TEMP (F)                                      VELOCITY (FT/SEC)                                                CORR TO 3% O2
----------------------------------------------------------------------------------------------------------------------------------------------------

241  10:33:36   99.6 16662  3368  3723  4297  3586  3726   930   244   348   608 20830        3368   930 15332  1200     0.20  0.26  1.10  1.25         4.3  40.0  14.6 635.0 500.0
                                                                                              150   599   599   375                                   0.0  50.3  18.4 798.5 628.7
  0    0.0     94.7          525   654   650   642   650   593   588   566   600               76    33   165    24                                   3.0  43.1  15.7 604.4 538.9
K-TRUN=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 6.00IN H20     TER WINDBOX P= 0.40IN H20     FURNACE P= 0.02IN H20     COAL P= 2.00IN H20
MILL IN=  477 F   MILL OUT= 140 F   EXIT= 1505 F   EXIT(sp)= 1651 F   SMPL= 1273 F   SEC WB= 599 F   TER WB= 375 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  87   BASELINE-UNSTAGED

310  11:09:09  102.6 17163  3335  3125  3315  2948  3210   940  1378  1404  1431 21086        3335   940 12598  4213     0.19  0.25  0.98  1.23         4.0  40.0  14.8 515.0 500.0
                                                                                              151   582   582   431                                   0.0  49.4  18.3 636.2 617.6
  0    0.0     94.7          528   650   645   636   646   571   632   611   620               75    33   133    88                                   3.0  42.4  15.7 545.3 529.4
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 3.20IN H20     TER WINDBOX P= 1.60IN H20     FURNACE P= 0.01IN H20     COAL P= 1.80IN H20
MILL IN=  481 F   MILL OUT= 152 F   EXIT= 1500 F   EXIT(sp)= 1407 F   SMPL= 1273 F   SEC WB= 582 F   TER WB= 431 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  88   STAGING CURVE

344  11:20:29  103.6 17320  3322  2690  2773  2093  2731   934  1785  2191  2219 21537        3322   934 11086  6195     0.19  0.25  0.89  1.24         4.2  40.0  14.4 405.0 500.0
                                                                                              151   576   576   460                                   0.0  50.6  18.0 506.3 625.0
  0    0.0     94.7          532   653   649   641   651   563   642   627   635               75    32   116   134                                   3.0  42.9  15.4 433.9 535.7
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.00IN H20     TER WINDBOX P= 1.00IN H20     FURNACE P= 0.01IN H20     COAL P= 2.00IN H20
MILL IN=  481 F   MILL OUT= 151 F   EXIT= 1492 F   EXIT(sp)= 1480 F   SMPL= 1266 F   SEC WB= 576 F   TER WB= 460 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  89   STAGING

404  11:54:34  105.0 17549  3300  2450  2572  2488  2402   931  2513  2589  2439 21685        3300   931  9912  7541     0.19  0.24  0.81  1.24         4.1  37.0  14.2 340.0 490.0
                                                                                              151   564   564   472                                   0.0  46.0  17.6 422.5 608.9
  0    0.0     94.7          534   649   644   636   649   551   646   630   637               75    32   103   165                                   3.0  39.4  15.1 362.1 521.9
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.20IN H20     TER WINDBOX P= 3.60IN H20     FURNACE P= 0.10IN H20     COAL P= 2.00IN H20
MILL IN=  484 F   MILL OUT= 152 F   EXIT= 1487 F   EXIT(sp)= 1343 F   SMPL= 1264 F   SEC WB= 564 F   TER WB= 472 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  91   BASELINE-STAGED

443  12:16:25  104.8 17517  3374  2022  2088  2025  1957   927  3219  3332  3215 22158        3374   927  8092  9766     0.19  0.25  0.71  1.26         4.5  38.0  13.4 300.0 460.0
                                                                                              153   564   564   496                                   0.0  48.4  17.1 381.8 585.5
  0    0.0     92.4          527   655   648   641   654   577   656   644   648               77    32    84   219                                   3.0  41.5  14.6 327.3 501.8
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.20IN H20     TER WINDBOX P= 3.60IN H20     FURNACE P= 0.10IN H20     COAL P= 2.00IN H20
MILL IN=  481 F   MILL OUT= 155 F   EXIT= 1437 F   EXIT(sp)= 1428 F   SMPL= 1233 F   SEC WB= 564 F   TER WB= 496 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  92   STAGING CURVE

471  12:30:16  107.4 17966  3462  1759  1952  1609  1648   929  3337  3891  3872 22460        3462   929  6969 11100     0.19  0.24  0.63  1.25         4.3  40.0  13.8 245.0 470.0
                                                                                              154   545   545   512                                   0.0  50.3  17.4 308.1 591.0
  0    0.0     92.4          523   662   650   645   660   587   668   656   661               79    31    71   253                                   3.0  43.1  14.9 264.1 506.6
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.20IN H20     TER WINDBOX P= 3.60IN H20     FURNACE P= 0.10IN H20     COAL P= 2.00IN H20
MILL IN=  473 F   MILL OUT= 159 F   EXIT= 1433 F   EXIT(sp)= 1436 F   SMPL= 1241 F   SEC WB= 545 F   TER WB= 512 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  93   MAX. STAGING

536  13:01:56  102.5 17147  3359  2374  2437  2391  2425   917  2690  2572  2270 21436        3359   917  9627  7532     0.20  0.25  0.81  1.25         4.3  35.0  14.2 330.0 500.0
                                                                                              152   569   569   474                                   0.0  44.0  17.9 415.0 628.7
  0    0.0     92.4          525   662   658   650   664   559   661   642   651               76    32   100   165                                   3.0  37.7  15.3 355.7 538.9
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.20IN H20     TER WINDBOX P= 3.60IN H20     FURNACE P= 0.10IN H20     COAL P= 2.00IN H20
MILL IN=  475 F   MILL OUT= 154 F   EXIT= 1494 F   EXIT(sp)= 1462 F   SMPL= 1265 F   SEC WB= 569 F   TER WB= 474 F         SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  94   BASELINE-STAGED
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DATE          :   02-13-84                                            TER DIA       :   8.0
SYSTEM        :   LWS                                                 TER LOC       :   INNER
BURNER        :   SSM-2                                               P.A.DES.      :   BL
FUEL          :   UTAH8                                               OIL CHECK     :   6.51
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             LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE  SEC   TER      PRIM  CORE  SEC   TOTAL        02   CO    C02   NO    S02
PT#    TIME  MBTU/HR  TA                         FLOW SCFM                                          FLOW SCFM                    SR (CUM)                              MEASURED
  OIL          CALC  SCFM                                                                           TEMP (F)                                                      CORR TO 0% 02
(%)   LOAD     MEAS                              TEMP (F)                                        VELOCITY (FT/SEC)                                                CORR TO 3% 02
-----------------------------------------------------------------------------------------------------------------------------------------------------------

580  13:23:13  103.2 17255  3411  2239  2577  2267  2355   964  2333  2099  1697 19941         3411   964  9437  6130     0.20  0.25  0.80  1.16         2.9  43.0  15.6  285.0  560.0
                                                                                                155   581   581   473                                  0.0  49.9  18.1  330.7  649.7
  0     0.0    92.4          523   688   681   672   688   582   684   661   667                78    34   100   134                                  3.0  42.0  15.5  283.4  556.9
K-TRON=8100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.20IN H20    TER WINDBOX P= 3.60IN H20    FURNACE P= 0.10IN H20    COAL P= 2.00IN H20
MILL IN=  474 F   MILL OUT= 160 F   EXIT= 1502 F   EXIT(sp)= 1457 F   SMPL= 1241 F   SEC WB= 581 F   TER WB= 473 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  95   EXCESS AIR CURVE

598  13:34:13  101.1 16908  3394  2239  2506  2203  2326   978  1943  1590  1175 18355         3394   978  9274  4709     0.20  0.26  0.81  1.09         1.7  50.0  16.8  260.0  630.0
                                                                                                154   610   610   492                                  0.0  54.4  18.3  282.9  685.5
  0     0.0    92.4          524   710   701   691   708   617   702   675   678                77    35   101   105                                  3.0  46.6  15.7  242.5  587.6
K-TRON=8100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.30IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.03IN H20    COAL P= 0.02IN H20
MILL IN=  472 F   MILL OUT= 156 F   EXIT= 1515 F   EXIT(sp)= 1506 F   SMPL= 1240 F   SEC WB= 610 F   TER WB= 492 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  96   MINIMUM EXCESS AIR

615  13:47:18  102.3 17110  3364  2374  2303  2494  2551   894  1607  3426  3023 22035         3364   894  9721  8055     0.20  0.25  0.82  1.29         4.8  42.0  13.6  365.0  480.0
                                                                                                155   614   614   508                                  0.0  54.4  17.6  473.1  622.2
  0     0.0    92.4          526   705   701   692   708   601   697   685   691                77    32   106   183                                  3.0  46.7  15.1  405.6  533.3
K-TRON=8100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.30IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.03IN H20    COAL P= 0.02IN H20
MILL IN=  475 F   MILL OUT= 164 F   EXIT= 1474 F   EXIT(sp)= 1465 F   SMPL= 1264 F   SEC WB= 614 F   TER WB= 508 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  97   EXCESS AIR CURVE

633  13:54:24  101.1 16902  3373  2281  2264  2453  2530   882  1503  4056  3824 23167         3373   882  9520  9384     0.20  0.25  0.82  1.37         5.0  37.0  13.0  360.0  450.0
                                                                                                157   593   593   511                                  0.0  51.1  18.0  497.4  621.7
  0     0.0    92.4          527   683   681   674   688   582   678   672   679                77    31   102   214                                  3.0  43.8  15.4  426.3  532.9
K-TRON=8100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.90IN H20    TER WINDBOX P= 6.50IN H20    FURNACE P= 0.01IN H20    COAL P= 2.30IN H20
MILL IN=  477 F   MILL OUT= 166 F   EXIT= 1464 F   EXIT(sp)= 1457 F   SMPL= 1261 F   SEC WB= 593 F   TER WB= 511 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  98   MAXIMUM EXCESS AIR
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DATE          :    02-13-84                          TER DIA      :    8.0
SYSTEM        :    LWS                               TER LOC      :    OUTER
BURNER        :    SSM-2                             P.A.DES.     :    BL
FUEL          :    UTAH8                             OIL CHECK    :    6.51

            LOAD           PRIM   V -2   V -3   V -4   V -5  CORE   V -7   V -8   V -9  TOTAL        PRIM   CORE   SEC    TER         PRIM  CORE  SEC   TOTAL          O2    CO     CO2    NO     SO2
PT#   TIME  MBTU/HR  TA                          FLOW SCFM                                                   FLOW SCFM                      SR (CUM)                                      MEASURED
  OIL        CALC   SCFM                                                                                     TEMP (F)                                                               CORR TO 0% O2
(%)   LOAD   MEAS                                TEMP (F)                                                VELOCITY (FT/SEC)                                                          CORR TO 3% O2

699  14:31:17   99.6 16657   3339   3732   3457   4145   3974   933    275    275    572  20702        3339    933  15308   1122        0.20  0.26  1.18  1.24           4.2   40.0   14.4  650.0  500.0
                                                                                                      152    602    602    355                                           0.0   50.0   18.0  812.5  625.0
  0    0.0      92.4           524    680    669    664    675   561    616    566    618          .     76     33    165     21                                           3.0   42.9   15.4  696.4  535.7
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 5.70IN H2O     TER WINDBOX P= 0.30IN H2O     FURNACE P= 0.15IN H2O     COAL P= 2.20IN H2O
MILL IN=  475 F    MILL OUT= 155 F    EXIT= 1532 F    EXIT(sp)= 1376 F    SMPL= 1304 F    SEC WB= 602 F    TER WB= 355 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  99   UNSTAGED-OUTER TERTIARY

756  14:57:09  103.2 17263   3341   3268   2968   3431   3415   931   1369   1514   1353  21581        3341    931  13082   4227        0.19  0.25  1.01  1.25           4.3   40.0   14.4  515.0  500.0
                                                                                                      154    591    591    454                                           0.0   50.3   18.1  647.6  628.7
  0    0.0      92.4           526    673    659    655    667   558    655    628    637                 76     33    139     91                                           3.0   43.1   15.5  555.1  538.9
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 4.00IN H2O     TER WINDBOX P= 1.20IN H2O     FURNACE P= 0.14IN H2O     COAL P= 2.20IN H2O
MILL IN=  474 F    MILL OUT= 158 F    EXIT= 1518 F    EXIT(sp)= 1507 F    SMPL= 1294 F    SEC WB= 591 F    TER WB= 454 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  13   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE 100   STAGING CURVE

771  15:13:36  103.5 17303   3305   2902   2742   2926   2982   916   1290   2404   2290  21758        3305    916  11552   5985        0.19  0.24  0.91  1.26           4.4   43.0   14.4  405.0  510.0
                                                                                                      153    591    591    484                                           0.0   54.4   18.2  512.3  645.2
  0    0.0      92.4           529    677    666    662    675   575    661    649    655                 75     32    123    133                                           3.0   46.6   15.6  439.2  553.0
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 4.00IN H2O     TER WINDBOX P= 1.20IN H2O     FURNACE P= 0.14IN H2O     COAL P= 2.20IN H2O
MILL IN=  477 F    MILL OUT= 158 F    EXIT= 1533 F    EXIT(sp)= 1509 F    SMPL= 1288 F    SEC WB= 591 F    TER WB= 484 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  14   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE 101   STAGING CURVE

815  15:34:02  105.3 17612   3279   2396   2307   2647   2427   927   2279   2736   2640  21638        3279    927   9777   7655        0.19  0.24  0.79  1.23           4.0   45.0   15.0  300.0  520.0
                                                                                                      152    577    577    499                                           0.0   55.6   18.5  370.6  642.4
  0    0.0      92.4           530    675    661    660    675   575    672    653    663                 74     32    103    172                                           3.0   47.6   15.9  317.6  550.6
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.10IN H2O     COAL P= 2.00IN H2O
MILL IN=  477 F    MILL OUT= 156 F    EXIT= 1509 F    EXIT(sp)= 1507 F    SMPL= 1270 F    SEC WB= 577 F    TER WB= 499 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  15   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE 102   BASELINE-STAGED-OUTER TERTS

845  15:48:08  107.7 18005   3357   2082   2048   2201   2030   922   1996   3886   3855  22377        3357    922   8361   9737        0.19  0.24  0.70  1.24           4.2   45.0   14.8  250.0  510.0
                                                                                                      153    572    572    516                                           0.0   56.3   18.5  312.5  637.5
  0    0.0      92.4           527    673    657    659    674   575    673    664    671                 76     32     87    223                                           3.0   48.2   15.9  267.9  546.4
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H2O     TER WINDBOX P= 5.60IN H2O     FURNACE P= 0.20IN H2O     COAL P= 2.20IN H2O
MILL IN=  476 F    MILL OUT= 155 F    EXIT= 1493 F    EXIT(sp)= 1489 F    SMPL= 1261 F    SEC WB= 572 F    TER WB= 516 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  16   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 103   STAGING CURVE-OUTER TERTS

860  16:00:19  103.9 17372   3416   1752   1783   1699   1614   932   2469   4591   4116  22372        3416    932   6848  11176        0.20  0.25  0.64  1.29           4.8   45.0   14.2  170.0  540.0
                                                                                                      152    513    513    519                                           0.0   58.3   18.4  220.4  700.0
  0    0.0      92.4           519    669    644    649    665   561    676    662    672                 77     30     67    257                                           3.0   50.0   15.8  188.9  600.0
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H2O     TER WINDBOX P= 5.60IN H2O     FURNACE P= 0.20IN H2O     COAL P= 2.20IN H2O
MILL IN=  471 F    MILL OUT= 154 F    EXIT= 1463 F    EXIT(sp)= 1455 F    SMPL= 1219 F    SEC WB= 513 F    TER WB= 519 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  17   ELAPSED TIME, MIN   3   RECORD ON TRK   0   FILE 104   MARGINAL FLAME STABILITY-STAGED

895  16:17:35  101.4 16947   3391   2217   2392   2231   2101   943   1977   3186   2383  20820        3391    943   8942   7545        0.20  0.26  0.78  1.23           4.0   40.0   14.6  290.0  520.0
                                                                                                      150    566    566    502                                           0.0   49.4   18.0  358.2  642.4
  0    0.0      92.4           521    676    665    656    672   557    674    662    668                 76     32     93    170                                           3.0   42.4   15.5  307.1  550.6
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H2O     TER WINDBOX P= 5.60IN H2O     FURNACE P= 0.20IN H2O     COAL P= 2.20IN H2O
MILL IN=  472 F    MILL OUT= 152 F    EXIT= 1522 F    EXIT(sp)= 1503 F    SMPL= 1259 F    SEC WB= 566 F    TER WB= 562 F           SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  18   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE 105   BASELINE -STAGING
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DATE      :   02-13-84                                       TER DIA     :   8.0
SYSTEM    :   LWS                                            TER LOC     :   OUTER
BURNER    :   SSM-2                                          P.A.DES.    :   BL
FUEL      :   UTAH8                                          OIL CHECK   :   6.51
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                LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL      O2    CO    CO2    NO     SO2
PT#    TIME   MBTU/HR  TA                      FLOW SCFM                                          FLOW SCFM                    SR (CUM)                        MEASURED
  OIL           CALC  SCFM                                                                          TEMP (F)                                                 CORR TO 0% O2
(%)    LOAD     MEAS                           TEMP (F)                                        VELOCITY (FT/SFC)                                             CORR TO 3% O2
---------------------------------------------------------------------------------------------------------------------------------------------

908 16:26:32  100.5 16799  3463  2210  2627  2349  2185   970  2000  2131  1480 19414       3463   970  9370  5611     0.21  0.26  0.82  1.16      2.9   45.0  15.8  280.0  560.0
                                                                                            151   585   585   497                                 0.0   52.2  18.3  324.9  649.7
 0     0.0     92.4          517   694   681   671   686   579   689   671   673               78    34    99   126                                 3.0   44.8  15.7  278.5  556.9
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H20     TER WINDBOX P= 5.60IN H20     FURNACE P= 0.20IN H20     COAL P= 2.20IN H20
MILL IN=  469 F   MILL OUT= 146 F   EXIT= 1520 F   EXIT(sp)= 1511 F   SMPL= 1252 F   SEC WB= 585 F   TER WB= 497 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  19   ELAPSED TIME, MIN   6   RECORD ON TRK    0   FILE 106   EXCESS AIR CURVE- STAGED

922 16:33:17  100.7 16834  3408  2254  2543  2270  2186   986  1902  1650   983 18183       3408   986  9254  4535     0.20  0.26  0.81  1.08      1.6   57.0  17.2  255.0  620.0
                                                                                            151   595   595   471                                 0.0   61.7  18.6  276.0  671.1
 0     0.0     92.4          519   711   696   686   703   590   701   681   679               77    35    99    99                                 3.0   52.9  16.0  236.6  575.3
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H20     TER WINDBOX P= 5.60IN H20     FURNACE P= 0.20IN H20     COAL P= 2.20IN H20
MILL IN=  472 F   MILL OUT= 154 F   EXIT= 1563 F   EXIT(sp)= 1542 F   SMPL= 1256 F   SEC WB= 595 F   TER WB= 471 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  20   ELAPSED TIME, MIN   7   RECORD ON TRK    0   FILE 107   MIN. EXCESS AIR

948 16:47:29   99.3 16609  3381  2219  2142  2350  2163   902  1373  3962  3028 21520       3381   902  8874  8364     0.20  0.26  0.79  1.30      4.9   45.0  14.0  320.0  500.0
                                                                                            153   616   616   534                                 0.0   58.7  18.3  417.4  652.2
 0     0.0     92.4          520   710   701   689   704   611   701   696   699               77    32    97   195                                 3.0   50.3  15.7  357.8  559.0
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H20     TER WINDBOX P= 5.60IN H20     FURNACE P= 0.20IN H20     COAL P= 2.20IN H20
MILL IN=  470 F   MILL OUT= 160 F   EXIT= 1506 F   EXIT(sp)= 1489 F   SMPL= 1272 F   SEC WB= 616 F   TER WB= 534 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  21   ELAPSED TIME, MIN   5   RECORD ON TRK    0   FILE 108   EXCESS AIR-STAGING

960 16:54:44  101.3 16940  3408  2134  2141  2323  2162   889  1215  4705  3947 22924       3408   889  8760  9867     0.20  0.25  0.77  1.35      5.6   45.0  14.2  315.0  400.0
                                                                                            155   591   591   527                                 0.0   61.4  19.4  429.5  654.5
 0     0.0     92.4          520   686   680   668   682   586   678   677   683               76    31    93   229                                 3.0   52.6  16.6  368.2  561.0
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H20     TER WINDBOX P= 5.60IN H20     FURNACE P= 0.20IN H20     COAL P= 2.20IN H20
MILL IN=  471 F   MILL OUT= 159 F   EXIT= 1504 F   EXIT(sp)= 1482 F   SMPL= 1273 F   SEC WB= 591 F   TER WB= 527 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  22   ELAPSED TIME, MIN   6   RECORD ON TRK    0   FILE 109   MAX. EXCESS AIR-STAGING OUTER TERTS

984 17:04:07  102.1 17077  3309  2251  2364  2347  2205   917  1354  3697  2657 21101       3309   917  9167  7708     0.19  0.25  0.78  1.24      4.1   45.0  14.1  295.0  520.0
                                                                                            154   571   571   505                                 0.0   55.9  17.5  366.6  646.2
 0     0.0     92.4          526   674   668   656   671   561   667   664   668               75    32    96   175                                 3.0   47.9  15.0  314.2  553.8
K-TRON=8100 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.30IN H20     TER WINDBOX P= 5.60IN H20     FURNACE P= 0.20IN H20     COAL P= 2.20IN H20
MILL IN=  478 F   MILL OUT= 157 F   EXIT= 1529 F   EXIT(sp)= 1499 F   SMPL= 1273 F   SEC WB= 571 F   TER WB= 505 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  23   ELAPSED TIME, MIN   6   RECORD ON TRK    0   FILE  20   BASELINE STAGED REPLICATE
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DATE          :    02-14-84                              TER DIA      :    8
SYSTEM        :    LWS                                   TER LOC      :    OUTER
BURNER        :    SSM-2                                 P.A.DES.     :    25%   BL
FUEL          :    UTAH8                                 OIL CHECK    :    6.45

                 LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER       PRIM  CORE   SEC  TOTAL        O2    CO   CO2    NO   SO2
PT#    TIME   MBTU/HR  TA                          FLOW SCFM                                            FLOW SCFM                       SR (CUM)                               MEASURED
  OIL            CALC  SCFM                                                                             TEMP (F)                                                           CORR TO 0% O2
(%)    LOAD      MEAS                              TEMP (F)                                        VELOCITY (FT/SEC)                                                       CORR TO 3% O2

389  11:54:03   104.1  17409  3141  3786  4417  4481  3385   956   219   319   561  21266        3141   956  16069  1099      0.18  0.24  1.16  1.22          3.9  40.0  14.8 335.0 520.0
                                                                                                  168   565    565   362                                        0.0  49.1  18.2 411.4 638.6
  0     0.0      93.5          647   641   637   630   635   537   578   547   591                 97    33    167    21                                        3.0  42.1  15.6 352.6 547.4
K-TRON=8200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  25.0 %    SEC WINDBOX P= 6.80IN H20    TER WINDBOX P= 0.50IN H20    FURNACE P= 0.10IN H20    COAL P= 5.50IN H20
MILL IN=  609 F   MILL OUT= 177 F   EXIT= 1536 F   EXIT(sp)= 1497 F   SMPL= 1280 F   SEC WB= 565 F   TER WB= 362 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 111   UNSTAGED WITH SPREADER( 25% BLOCKAGE )

440  12:21:08   102.3  17101  3137  3193  3612  3531  2673   966  1288  1309  1668  21379        3137   966  13009  4266      0.18  0.24  1.00  1.25          4.3  43.0  14.2 270.0 500.0
                                                                                                  169   546    546   425                                        0.0  54.1  17.9 339.5 628.7
  0     0.0      93.5          638   636   630   621   630   524   616   591   609                 97    33    133    89                                        3.0  46.3  15.3 291.0 538.9
K-TRON=8200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  25.0 %    SEC WINDBOX P= 6.80IN H20    TFR WINDBOX P= 0.50IN H20    FURNACE P= 0.10IN H20    COAL P= 5.50IN H20
MILL IN=  605 F   MILL OUT= 177 F   EXIT= 1516 F   EXIT(sp)= 1477 F   SMPL= 1271 F   SEC WB= 546 F   TER WB= 425 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 112   STAGING CURVE

486  12:40:47   104.1  17399  3189  2792  3421  3014  2317   966  1844  1805  2275  21624        3189   966  11544  5924      0.18  0.24  0.90  1.24          4.2  55.0  14.2 235.0 520.0
                                                                                                  168   565    565   460                                        0.0  68.8  17.8 293.8 650.0
  0     0.0      93.5          633   644   637   627   636   564   633   612   624                 99    33    120   128                                        3.0  58.9  15.2 251.8 557.1
K-TRON=8200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  25.0 %    SEC WINDBOX P= 3.30IN H20    TER WINDBOX P= 2.10IN H20    FURNACE P= 0.09IN H20    COAL P= 5.60IN H20
MILL IN=  599 F   MILL OUT= 170 F   EXIT= 1467 F   EXIT(sp)= 1472 F   SMPL= 1254 F   SEC WB= 565 F   TER WB= 460 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 113   STAGING CURVE

502  12:58:57   105.1  17569  3175  2503  2997  2641  2104   963  2413  2467  2962  22224        3175   963  10244  7842      0.18  0.24  0.82  1.26          4.5  75.0  14.2 230.0 520.0
                                                                                                  168   555    555   474                                        0.0  95.5  18.1 292.7 661.8
  0     0.0      93.5          631   644   639   628   637   545   639   618   631                 98    33    105   172                                        3.0  81.8  15.5 250.9 567.3
K-TRON=8200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  25.0 %    SEC WINDBOX P= 3.30IN H20    TER WINDBOX P= 2.10IN H20    FURNACE P= 0.09IN H20    COAL P= 5.60IN H20
MILL IN=  599 F   MILL OUT= 176 F   EXIT= 1528 F   EXIT(sp)= 1519 F   SMPL= 1253 F   SEC WB= 555 F   TER WB= 474 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   3   RECORD ON TRK   0   FILE 114   MAX. STAGING-FLAMES ON WALL CONTINUOUS

560  13:23:47   102.6  17152  3154  3722  4546  4323  3385   953   498   304   556  21442        3154   953  15977  1358      0.18  0.24  1.17  1.25          4.3  43.0  14.6 340.0 520.0
                                                                                                  169   575    575   361                                        0.0  54.1  18.4 427.5 653.9
  0     0.0      93.5          629   650   643   635   642   553   610   550   597                 98    33    167    26                                        3.0  46.3  15.7 366.5 560.5
K-TKON=8200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  25.0 %    SEC WINDBOX P= 3.30IN H20    TER WINDBOX P= 2.10IN H20    FURNACE P= 0.09IN H20    COAL P= 5.60IN H20
MILL IN=  594 F   MILL OUT= 184 F   EXIT= 1518 F   EXIT(sp)= 1500 F   SMPL= 1274 F   SEC WB= 575 F   TER WB= 361 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 115   UNSTAGED-REPLICATE

836  15:56:27    95.2  15912  2606  3619  3516  5418  3050   875   430   312   543  20370        2606   875  15603  1285      0.16  0.22  1.20  1.28          4.7  40.0  13.4 340.0 480.0
                                                                                                  159   527    527   328                                        0.0  51.5  17.3 438.0 618.4
  0     0.0      94.7          727   629   623   618   619   503   586   531   574                119    29    156    24                                        3.0  44.2  14.8 375.5 530.1
K-TKON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  50.0 %    SEC WINDBOX P= 6.40IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.10IN H20    COAL P= 8.50IN H20
MILL IN=  609 F   MILL OUT= 174 F   EXIT= 1482 F   EXIT(sp)= 1468 F   SMPL= 1266 F   SEC WB= 527 F   TER WB= 328 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 116   BASELINE-UNSTAGED-50% BLOCKAGE

890  16:25:04    95.9  16043  2672  2854  2771  4605  2252   896  1576  1536  1011  20174        2672   896  12483  4123      0.17  0.22  1.00  1.26          4.4  60.0  13.8 230.0 500.0
                                                                                                  162   525    525   408                                        0.0  75.9  17.5 291.0 632.5
  0     0.0      94.7          712   630   623   617   617   508   618   590   593                123    30    125    84                                        3.0  65.1  15.0 249.4 542.2
K-TKON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  50.0 %    SEC WINDBOX P= 6.40IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.10IN H20    COAL P= 8.50IN H20
MILL IN=  677 F   MILL OUT= 173 F   EXIT= 1427 F   EXIT(sp)= 1400 F   SMPL= 1241 F   SEC WB= 525 F   TER WB= 408 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE 117   STAGING CURVE-MAX. BLOCKAGE
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DATE          :     02-16-84                                    TER DIA         :     8
SYSTEM        :     LWS                                         TER LOC         :     OUTER
BURNER        :     SSM-2                                       P.A.DES.        :     VENTURI
FUEL          :     UTAH8                                       OIL CHECK       :     5.56

                 LOAD        PRIM   V -2   V -3   V -4   V -5   CORE   V -7   V -8   V -9   TOTAL     PRIM   CORE    SEC    TER      PRIM   CORE   SEC   TOTAL        02     CO    CO2     NO    SO2
PT#    TIME    MBTU/HR  TA                                FLOW SCFM                                          FLOW SCFM                         SR (CUM)                                    MEASURED
  OIL            CALC  SCFM                                                                                   TEMP (F)                                                              CORR TO 0% O2
(%)    LOAD      MEAS                                      TEMP (F)                                        VELOCITY (FT/SEC)                                                         CORR TO 3% O2

433  11:47:51   101.7  17005   3417   3026   4729   5004   2739    954    502    333    554  21256     3417    954  15498   1389     0.20   0.26   1.17   1.25         4.3   40.0   14.8  645.0  490.0
                                                                                                        161    552    552    334                                        0.0   50.3   18.6  811.1  616.2
  0     0.0      94.7          593    643    641    625    627    528    590    521    576              79     32    159     26                                        3.0   43.1   16.0  695.2  528.1
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 4.70IN H20    TER WINDBOX P= 0.80IN H20    FURNACE P= 0.05IN H20    COAL P= 3.20IN H20
MILL IN=  553 F   MILL OUT= 170 F   EXIT= 1507 F   EXIT(sp)= 1716 F   SMPL= 1195 F   SEC WB= 552 F   TER WB= 334 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 118   BASELINE-UNSTAGED-VENTURI

505  12:22:47   101.4  16954   3268   2582   3677   4110   2365   1054   1397   1252   1605  21319     3268   1054  12742   4255     0.19   0.25   1.01   1.26         4.4   40.0   14.8  535.0  480.0
                                                                                                        160    525    525    389                                        0.0   50.6   18.7  676.8  607.2
  0     0.0      94.7          583    622    622    606    610    517    605    570    589              75     35    127     85                                        3.0   43.4   16.0  580.1  520.5
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 3.60IN H20    TER WINDBOX P= 0.80IN H20    FURNACE P= 0.10IN H20    COAL P= 3.10IN H20
MILL IN=  539 F   MILL OUT= 172 F   EXIT= 1510 F   EXIT(sp)= 1514 F   SMPL= 1202 F   SEC WB= 525 F   TER WB= 389 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE 119   STAGING CURVE

 69  13:02:40    99.5  16634   3297   2360   2833   3310   2243   1051   1967   1480   2377  20918     3297   1051  10746   5823     0.20   0.26   0.91   1.26         4.4   40.0   14.6  435.0  500.0
                                                                                                        161    535    535    428                                        0.0   50.6   18.5  550.3  632.5
  0     0.0      94.7          567    623    624    603    613    534    622    586    610              76     35    108    122                                        3.0   43.4   15.8  471.7  542.2
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 3.60IN H20    TER WINDBOX P= 0.80IN H20    FURNACE P= 0.10IN H20    COAL P= 3.10IN H20
MILL IN=  511 F   MILL OUT= 171 F   EXIT= 1506 F   EXIT(sp)= 1463 F   SMPL= 1103 F   SEC WB= 535 F   TER WB= 428 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE 120   STAGING CURVE

119  13:21:35   100.3  16764   3251   2179   2096   2749   2003   1060   3080   1369   3049  20836     3251   1060   9026   7499     0.19   0.26   0.80   1.24         4.2   40.0   14.4  340.0  500.0
                                                                                                        162    538    538    443                                        0.0   50.0   18.0  425.0  625.0
  0     0.0      94.7          591    621    620    595    607    535    627    582    611              75     35     91    159                                        3.0   42.9   15.4  364.3  535.7
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.01IN H20    COAL P= 3.10IN H20
MILL IN=  542 F   MILL OUT= 172 F   EXIT= 1498 F   EXIT(sp)= 1724 F   SMPL= 1176 F   SEC WB= 538 F   TER WB= 443 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE 121   BASELINE-STAGED

160  13:40:27   101.8  17026   3274   1920   1630   2214   1679   1055   3104   3040   3123  21039     3274   1055   7443   9267     0.19   0.25   0.69   1.24         4.1   40.0   14.4  250.0  540.0
                                                                                                        163    519    519    469                                        0.0   49.7   17.9  310.7  671.0
  0     0.0      94.7          567    625    621    592    607    537    637    611    623              75     35     74    202                                        3.0   42.6   15.3  266.3  575.1
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 3.60IN H20    FURNACE P= 0.02IN H20    COAL P= 3.20IN H20
MILL IN=  519 F   MILL OUT= 176 F   EXIT= 1457 F   EXIT(sp)=  209 F   SMPL= 1159 F   SEC WB= 519 F   TER WB= 469 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE 122   STAGING CURVE

189  14:04:59    99.4  16616   3278   1753   1374   1939   1516   1050   3423   3348   3463  21144     3278   1050   6582  10234     0.20   0.26   0.66   1.27         4.6   37.0   13.8  235.0  520.0
                                                                                                        162    519    519    485                                        0.0   47.4   17.7  300.9  665.9
  0     0.0      94.7          575    631    627    595    614    543    651    627    639              75     34     65    227                                        3.0   40.6   15.1  257.9  570.7
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 3.60IN H20    FURNACE P= 0.02IN H20    COAL P= 3.20IN H20
MILL IN=  515 F   MILL OUT= 172 F   EXIT= 1456 F   EXIT(sp)=  222 F   SMPL= 1157 F   SEC WB= 519 F   TER WB= 485 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE 123   MAX. STAGING

271  14:36:41    99.6  16661   3223   2275   2131   2699   2097   1044   2535   2482   2715  21201     3223   1044   9202   7731     0.19   0.26   0.81   1.27         4.6   35.0   14.4  360.0  500.0
                                                                                                        162    541    541    467                                        0.0   44.8   18.4  461.0  640.2
  0     0.0      94.7          596    640    636    607    624    542    645    615    628              74     35     93    168                                        3.0   38.4   15.8  395.1  540.8
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 3.60IN H20    FURNACE P= 0.02IN H20    COAL P= 3.20IN H20
MILL IN=  541 F   MILL OUT= 173 F   EXIT= 1509 F   EXIT(sp)=  223 F   SMPL= 1193 F   SEC WB= 541 F   TER WB= 467 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN  15   RECORD ON TRK   0   FILE 124   BASELINE-SO2 TEST
```

```
DATE           :  02-16-84                     TER DIA      :  8
SYSTEM         :  LWS                          TER LOC      :  OUTER
BURNER         :  SSM-2                        P.A.DES.     :  VENTURI
FUEL           :  UTAH8                        OIL CHECK    :  5.56
-------------------------------------------------------------------------------------------------------------------------------------
               LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL    PRIM  CORE  SEC   TER     PRIM  CORE  SEC   TOTAL    O2   CO    CO2   NO    SO2
PT#    TIME   MBTU/HR  TA                      FLOW SCFM                                    FLOW SCFM                  SR (CUM)                      MEASURED
  OIL          CALC  SCFM                                                                    TEMP (F)                                                  CORR TO 0% O2
(%)    LOAD    MEAS                            TEMP (F)                                  VELOCITY (FT/SEC)                                           CORR TO 3% O2
-------------------------------------------------------------------------------------------------------------------------------------

303  14:53:37   98.3 16436  3274  2313  1899  2606  1962  1050  2485  2472  2598 20668    3274  1058  8781  7555    0.20  0.26  0.80  1.26     4.4  35.0  14.6  330.0 500.0
                                                                                          160   523   523   454                               0.0  44.3  18.5  417.5 632.5
  0    0.0      94.7         615   639   635   608   627   531   644   616   630           75    35    87   162                               3.0  38.0  15.8  357.8 542.2
I-TRON=8300 LBS/HR    CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.00IN H2O     TER WINDBOX P= 3.60IN H2O     FURNACE P= 0.02IN H2O     COAL P= 3.20IN H2O
MILL IN=  543 F   MILL OUT= 172 F   EXIT= 1485 F   EXIT(sp)=  241 F   SMPL= 1181 F   SEC WB= 523 F   TER WB= 454 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN  12   RECORD ON TRK   0   FILE 125   STAGED-BASELINE-SO2 TEST
```

```
DATE        :  02-17-84                                                    TER DIA      :  8
SYSTEM      :  LWS                                                         TER LOC      :  OUTER
BURNER      :  SSM-2                                                       P.A.DES.     :  BL
FUEL        :  UTAH8                                                       OIL CHECK    :  4.8

                LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER      PRIM  CORE  SEC  TOTAL        O2    CO    CO2    NO    SO2
PT#   TIME    MBTU/HR  TA                         FLOW SCFM                                          FLOW SCFM                  SR (CUM)                            MEASURED
  OIL           CALC  SCFM                                                                            TEMP (F)                                                   CORR TO 0% O2
(%)   LOAD      MEAS                              TEMP (F)                                       VELOCITY (FT/SEC)                                               CORR TO 3% O2

184  10:27:29   99.9 16696  3362  3698  3742  4548  3454   854   326   282   606 20873        3362   854 15442  1215      0.20  0.25  1.18  1.25        4.3  35.0  14.4 610.0 510.0
                                                                                               161   581   581   373                                    0.0  44.0  18.1 767.1 641.3
  0    0.0      97.0         593   654   649   637   647   571   594   555   597                 77    30   163    24                                    3.0  37.7  15.5 657.5 549.7
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 5.40IN H2O   TER WINDBOX P= 0.07IN H2O   FURNACE P= 0.19IN H2O   COAL P= 2.10IN H2O
MILL IN=  524 F  MILL OUT= 172 F  EXIT= 1521 F  EXIT(sp)= 1711 F  SMPL= 1212 F  SEC WB= 581 F  TER WB= 373 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  1  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE 126  BASELINE UNSTAGED

233  10:51:26   98.5 16467  3313  3032  2725  3561  2747   875  1288  1314  1612 20466        3313   875 12065  4213      0.20  0.25  0.99  1.24        4.2  35.0  14.6 460.0 510.0
                                                                                               161   565   565   434                                    0.0  43.8  18.3 575.0 637.5
  0    0.0      97.0         590   640   634   618   638   538   628   600   618                 76    30   125    89                                    3.0  37.5  15.6 492.9 546.4
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 5.40IN H2O   TER WINDBOX P= 0.07IN H2O   FURNACE P= 0.19IN H2O   COAL P= 2.10IN H2O
MILL IN=  527 F  MILL OUT= 172 F  EXIT= 1517 F  EXIT(sp)= 1707 F  SMPL= 1205 F  SEC WB= 565 F  TER WB= 434 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  2  ELAPSED TIME, MIN  7  RECORD ON TRK  0  FILE  21  BASELINE STAGING CURVE

257  11:03:36  100.9 16878  3274  2871  2361  3271  2556   856  1857  2043  2261 21350        3274   856 11059  6161      0.19  0.24  0.90  1.26        4.5  37.0  14.2 400.0 510.0
                                                                                               162   567   567   465                                    0.0  47.1  18.1 509.1 649.1
  0    0.0      97.0         598   637   630   619   630   565   627   607   618                 75    29   115   134                                    3.0  40.4  15.5 436.4 556.4
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 2.00IN H2O   TER WINDBOX P= 1.60IN H2O   FURNACE P= 0.01IN H2O   COAL P= 2.10IN H2O
MILL IN=  530 F  MILL OUT= 169 F  EXIT= 1517 F  EXIT(sp)= 1681 F  SMPL= 1205 F  SEC WB= 567 F  TER WB= 465 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  3  ELAPSED TIME, MIN  9  RECORD ON TRK  0  FILE 128  BASELINE STAGING CURVE

334  11:41:47  104.8 17524  3276  2517  2059  2911  2302   857  2533  2717  2609 21780        3276   857  9789  7859      0.19  0.24  0.79  1.24        4.2  40.0  14.6 315.0 520.0
                                                                                               163   549   549   482                                    0.0  50.0  18.3 393.8 650.0
  0    0.0      97.0         587   639   634   623   633   532   636   621   627                 75    29   100   174                                    3.0  42.9  15.6 337.5 557.1
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 2.00IN H2O   TER WINDBOX P= 3.20IN H2O   FURNACE P= 0.40IN H2O   COAL P= 2.30IN H2O
MILL IN=  522 F  MILL OUT= 176 F  EXIT= 1529 F  EXIT(sp)= 1725 F  SMPL= 1211 F  SEC WB= 549 F  TER WB= 482 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  4  ELAPSED TIME, MIN  7  RECORD ON TRK  0  FILE 129  STAGING CURVE-BL

384  12:03:40  105.5 17641  3292  2138  1406  2337  1837   856  3017  3362  3182 21428        3292   856  7718  9561      0.19  0.24  0.67  1.21        3.8  40.0  15.0 235.0 560.0
                                                                                               163   548   548   491                                    0.0  48.8  18.3 286.9 683.7
  0    0.0      97.0         587   632   623   610   622   557   634   620   624                 76    29    79   214                                    3.0  41.9  15.7 245.9 586.0
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 2.00IN H2O   TER WINDBOX P= 6.30IN H2O   FURNACE P= 0.16IN H2O   COAL P= 2.20IN H2O
MILL IN=  532 F  MILL OUT= 174 F  EXIT= 1496 F  EXIT(sp)=  243 F  SMPL= 1187 F  SEC WB= 548 F  TER WB= 491 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  5  ELAPSED TIME, MIN  8  RECORD ON TRK  0  FILE  22  MINIMUN BURNER SR

432  12:32:07  103.8 17352  3291  2600  2051  2868  2309   854  2408  2766  2419 21567        3291   854  9828  7594      0.19  0.24  0.81  1.24        4.2  40.0  14.6 320.0 530.0
                                                                                               163   550   550   478                                    0.0  50.0  18.3 400.0 662.5
  0    0.0      97.0         583   639   631   619   629   536   634   621   627                 76    29   101   167                                    3.0  42.9  15.6 342.9 567.9
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 2.00IN H2O   TER WINDBOX P= 6.30IN H2O   FURNACE P= 0.16IN H2O   COAL P= 2.20IN H2O
MILL IN=  523 F  MILL OUT= 171 F  EXIT= 1540 F  EXIT(sp)= 1745 F  SMPL= 1218 F  SEC WB= 550 F  TER WB= 478 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  6  ELAPSED TIME, MIN  9  RECORD ON TRK  0  FILE 131  BASELINE STAGED

462  12:46:12  108.5 18139  3208  2635  1999  2872  2294   880  1936  2248  1820 19892        3208   880  9801  6004      0.18  0.23  0.77  1.10        1.9  48.0  16.8 260.0 660.0
                                                                                               163   557   557   475                                    0.0  52.8  18.5 285.9 725.7
  0    0.0      97.0         564   662   652   640   649   534   653   637   640                 74    30   101   132                                    3.0  45.2  15.8 245.0 622.0
K-TRON=8500 LBS/HR   CORE=  45 DEG   SEC SWIRL SETTING= 2.40   CM   SPREADER BLOCKAGE=   0.0 %   SEC WINDBOX P= 2.20IN H2O   TER WINDBOX P= 2.10IN H2O   FURNACE P= 0.30IN H2O   COAL P= 2.40IN H2O
MILL IN=  521 F  MILL OUT= 173 F  EXIT= 1567 F  EXIT(sp)= 1656 F  SMPL= 1220 F  SEC WB= 557 F  TER WB= 475 F        SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM  [Ca]/[S]=  0.00
VALID DATA POINT #  7  ELAPSED TIME, MIN  5  RECORD ON TRK  0  FILE 132  EXCESS AIR CURVE
```

```
DATE          :   02-17-84                        TER DIA       :   8
SYSTEM        :   LWS                             TER LOC       :   OUTER
BURNER        :   SSM-2                           P.A.DES.      :   BL
FUEL          :   UTAH8                           OIL CHECK     :   4.8

                 LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL       PRIM  CORE   SEC   TER      PRIM  CORE  SEC  TOTAL       O2    CO    CO2    NO    SO2
PT#     TIME   MBTU/HR  TA                       FLOW SCFM                                          FLOW SCFM                   SR (CUM)                             MEASURED
  OIL            CALC  SCFM                                                                          TEMP (F)                                                        CORR TO 0% O2
(%)    LOAD      MEAS                             TEMP (F)                                       VELOCITY (FT/SEC)                                                   CORR TO 3% O2

522  13:13:26   100.5 16802  3355  2539  1780  2753  2175   889  1940  2119  1661 19211       3355   889  9247  5719     0.20  0.25  0.80  1.14        2.7  40.0  15.0 300.0 600.0
                                                                                                162   568   568   472                                 0.0  45.9  18.1 344.3 668.5
 0      0.0      97.0         515   671   663   650   660   542   665   641   651                77    31    96   125                                 3.0  39.3  15.5 295.1 590.2
K-TRON=8500 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.10IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  470 F   MILL OUT= 177 F   EXIT= 1540 F   EXIT(sp)= 1537 F   SMPL= 1203 F   SEC WB= 568 F   TER WB= 472 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE 133   EXCESS AIR CURVE

551  13:37:07   102.5 17135  3314  2702  2042  2905  2307   823  2855  3246  2702 22897       3314   823  9957  8803     0.19  0.24  0.82  1.34        5.4  30.0  14.2 350.0 460.0
                                                                                                163   568   568   499                                 0.0  40.4  19.1 471.2 619.2
 0      0.0      97.0         556   654   640   638   647   551   653   640   644                76    28   104   198                                 3.0  34.6  16.4 403.8 530.8
K-TRON=8500 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.10IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  490 F   MILL OUT= 172 F   EXIT= 1543 F   EXIT(sp)= 1778 F   SMPL= 1236 F   SEC WB= 568 F   TER WB= 499 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE 134   EXCESS AIR CURVE

560  13:44:06   102.7 17169  3288  2627  2004  2826  2226   804  3467  3769  3145 24156       3288   804  9683 10381     0.19  0.24  0.80  1.41        6.2  30.0  12.4 350.0 440.0
                                                                                                163   539   539   488                                 0.0  42.6  17.6 496.6 624.3
 0      0.0      97.0         564   639   634   623   632   514   641   621   632                76    27    98   231                                 3.0  36.5  15.1 425.7 535.1
K-TRON=8500 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 5.80IN H2O     FURNACE P= 0.50IN H2O     COAL P= 2.10IN H2O
MILL IN=  525 F   MILL OUT= 174 F   EXIT= 1515 F   EXIT(sp)= 1708 F   SMPL= 1219 F   SEC WB= 539 F   TER WB= 488 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   4   RECORD ON TRK   1   FILE   5   MAX. EXCESS AIR

629  14:12:01    76.2 12740  3234  2670  2120  2907  2771   919   300   292   623 15844       3234   919 10476  1215     0.25  0.33  1.15  1.24        4.2  30.0  14.0 480.0 500.0
                                                                                                161   625   625   370                                 0.0  37.5  17.5 600.0 625.0
 0      0.0      68.4         519   735   720   702   717   603   651   600   663                74    33   115    24                                 3.0  32.1  15.0 514.3 535.7
K-TRON=6000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 5.80IN H2O     FURNACE P= 0.50IN H2O     COAL P= 2.10IN H2O
MILL IN=  461 F   MILL OUT= 172 F   EXIT= 1467 F   EXIT(sp)= 1544 F   SMPL= 1128 F   SEC WB= 625 F   TER WB= 370 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN  12   RECORD ON TRK   1   FILE   4   UNSTAGED-75 % LOAD
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```
DATE        :    02-21-84                                   TER DIA     :   8
SYSTEM      :    LWS                                        TER LOC     :   OUTER
BURNER      :    SSM-2                                      P.A.DES.    :   BL
FUEL        :    UTAH8                                      OIL CHECK   :   6.5

               LOAD         PRIM   V -2   V -3   V -4   V -5  CORE   V -7   V -8   V -9  TOTAL          PRIM  CORE   SEC    TER        PRIM  CORE   SEC  TOTAL          O2    CO    CO2    NO    SO2
PT#    TIME  MBTU/HR  TA                             . FLOW SCFM                                            FLOW SCFM                   SR (CUM)                                MEASURED
  OIL           CALC  SCFM                                                                                   TEMP (F)                                                        CORR TO 0% O2
(%)    LOAD     MEAS                                      TEMP (F)                                      VELOCITY (FT/SEC)                                                    CORR TO 3% O2

210  09:31:13   100.0 16725   3415   3375   3989   3537   4073    863    382    287    628 20548          3415   863  14973  1297       0.20  0.26  1.15  1.23          4.0   40.0  14.6  610.0  520.0
                                                                                                          151   596    596   375                                         0.0   49.4  18.0  753.5  642.4
  0     0.0      91.3          519    660    657    645    654    564    607    562    606                 77    31    160    25                                         3.0   42.4  15.5  645.9  550.6
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 5.50IN H2O     TER WINDBOX P= 0.01IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.10IN H2O
MILL IN=  465 F   MILL OUT= 156 F   EXIT= 1516 F   EXIT(sp)= 1724 F   SMPL= 1200 F   SEC WB= 596 F   TER WB= 375 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   9   RECORD ON TRK   1   FILE   6   BASELINE UNSTAGED

241  09:51:07   101.0 16881   3386   2752   2968   2811   3384    878   1248   1667   1646 20740          3386   878  11915  4561       0.20  0.25  0.96  1.23          4.0   40.0  14.4  480.0  520.0
                                                                                                          152   573    573   447                                         0.0   49.4  17.8  592.9  642.4
  0     0.0      91.3          519    648    645    629    644    539    629    609    621                 77    30    125    97                                         3.0   42.4  15.2  508.2  550.6
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.80IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.40IN H2O     COAL P= 2.00IN H2O
MILL IN=  469 F   MILL OUT= 163 F   EXIT= 1527 F   EXIT(sp)=  229 F   SMPL= 1208 F   SEC WB= 573 F   TER WB= 447 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  23   STAGING CURVE

354  10:45:45    99.5 16645   3345   2285   2173   2229   2506    871   2042   2672   2565 20687          3345   871   9193  7278       0.20  0.25  0.81  1.24          4.2   40.0  14.0  310.0  490.0
                                                                                                          155   566    566   485                                         0.0   50.0  17.5  387.5  612.5
  0     0.0      91.3          528    652    649    634    649    553    646    631    639                 76    30     96   162                                         3.0   42.9  15.0  332.1  525.0
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  476 F   MILL OUT= 162 F   EXIT= 1504 F   EXIT(sp)= 1661 F   SMPL= 1182 F   SEC WB= 566 F   TER WB= 485 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE   8   BASELINE-STAGED

 77  11:38:51    98.0 16381   3341   2211   2184   2248   2489    851   2006   2635   2513 20478          3341   851   9132  7153       0.20  0.26  0.81  1.25          4.3   40.0  14.6  300.0  500.0
                                                                                                          155   582    582   498                                         0.0   50.3  18.4  377.2  628.7
  0     0.0      91.3          528    671    669    654    669    565    666    651    659                 76    30     96   161                                         3.0   43.1  15.7  323.4  538.9
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  474 F   MILL OUT= 159 F   EXIT= 1498 F   EXIT(sp)= 1544 F   SMPL= 1189 F   SEC WB= 582 F   TER WB= 498 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE   9   BASELINE STAGED (REPLICATE)

107  11:51:21    99.0 16554   3323   2242   2195   2211   2460    841   2121   2707   2595 20694          3323   841   9108  7423       0.20  0.25  0.80  1.25          4.3   40.0  15.0  300.0  310.0
                                                                                                          158   592    592   503                                         0.0   50.3  18.9  377.2  389.8
  0     0.0      91.3          528    674    672    659    673    583    667    652    662                 76    30     97   168                                         3.0   43.1  16.2  323.4  334.1
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  477 F   MILL OUT= 166 F   EXIT= 1523 F   EXIT(sp)= 1508 F   SMPL= 1205 F   SEC WB= 592 F   TER WB= 503 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 612     SORBENT AIR FLOW=  240  SCFM   [Ca]/[S]=  3.35
VALID DATA POINT #   2   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  24   LIMESTONE INJECTION CURVE

128  12:06:57    99.8 16691   3311   2256   2209   2236   2495    840   2147   2734   2638 20866          3311   840   9196  7518       0.20  0.25  0.80  1.25          4.3   40.0  14.8  310.0  480.0
                                                                                                          159   580    580   499                                         0.0   50.3  18.6  389.8  603.6
  0     0.0      91.3          530    675    674    659    674    547    671    656    664                 76    29     97   169                                         3.0   43.1  16.0  334.1  517.4
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  477 F   MILL OUT= 166 F   EXIT= 1522 F   EXIT(sp)= 1486 F   SMPL= 1201 F   SEC WB= 580 F   TER WB= 499 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  11   BASELINE

179  12:31:24    99.7 16672   3327   2279   2224   2256   2510    856   2066   2720   2605 20842          3327   856   9268  7391       0.20  0.25  0.81  1.25          4.3   40.0  14.6  320.0  330.0
                                                                                                          158   582    582   495                                         0.0   50.3  18.4  402.4  415.0
  0     0.0      91.3          526    669    669    652    664    560    668    642    657                 76    30     98   166                                         3.0   43.1  15.7  344.9  355.7
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGF=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.35IN H2O     COAL P= 2.00IN H2O
MILL IN=  471 F   MILL OUT= 164 F   EXIT= 1525 F   EXIT(sp)= 1546 F   SMPL= 1213 F   SEC WB= 582 F   TER WB= 495 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 432     SORBENT AIR FLOW=  236  SCFM   [Ca]/[S]=  2.35
VALID DATA POINT #   4   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  25   LIMESTONE INJECTION
```

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DATE         :   02-21-84                                      TER DIA      :   8
SYSTEM       :   LWS                                           TER LOC      :   OUTER
BURNER       :   SSM-2                                         P.A.DES.     :   BL
FUEL         :   UTAH8                                         OIL CHECK    :   6.5

                LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL       O2   CO    CO2   NO    SO2
PT#     TIME  MBTU/HR  TA                           FLOW SCFM                                        FLOW SCFM                   SR (CUM)                          MEASURED
   OIL                CALC  SCFM                                                                     TEMP (F)                                                  CORR TO 0% O2
(%)    LOAD           MEAS                                 TEMP (F)                               VELOCITY (FT/SEC)                                            CORR TO 3% O2

196  12:40:30   100.5 16809  3366  2259  2239  2248  2525   853  2067  2726  2608 20891      3366   853  9271  7401      0.20  0.25  0.80  1.24        4.2  40.0  14.4 320.0 460.0
                                                                                              157   576   576   491                                    0.0  50.0  18.0 400.0 575.0
  0    0.0      91.3          523   669   669   650   664   546   667   648   659               77    30    97   165                                    3.0  42.9  15.4 342.9 492.9
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  465 F   MILL OUT= 165 F   EXIT= 1517 F   EXIT(sp)=  319 F   SMPL= 1211 F   SEC WB= 576 F   TER WB= 491 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  13   BASELINE STAGED

225  12:53:48    99.4 16624  3385  2286  2185  2265  2547   858  2089  2708  2581 20904      3385   858  9284  7377      0.20  0.26  0.81  1.26        4.4  38.0  14.2 320.0 490.0
                                                                                              158   573   573   488                                    0.0  48.1  18.0 404.8 619.9
  0    0.0      91.3          518   667   666   648   664   550   668   647   658               77    30    97   164                                    3.0  41.2  15.4 347.0 531.3
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  464 F   MILL OUT= 164 F   EXIT= 1507 F   EXIT(sp)=  232 F   SMPL= 1204 F   SEC WB= 573 F   TER WB= 488 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  14   BASELINE STAGED

263  13:13:02   100.8 16856  3350  2255  2256  2262  2557   860  2081  2714  2615 20950      3350   860  9330  7410      0.20  0.25  0.80  1.24        4.2  40.0  14.6 320.0 410.0
                                                                                              159   575   575   492                                    0.0  50.0  18.3 400.0 512.5
  0    0.0      91.3          518   664   663   643   659   552   665   644   654               77    30    98   166                                    3.0  42.9  15.6 342.9 439.3
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  466 F   MILL OUT= 165 F   EXIT= 1541 F   EXIT(sp)= 1676 F   SMPL= 1221 F   SEC WB= 575 F   TER WB= 492 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 240     SORBENT AIR FLOW=  243  SCFM   [Ca]/[S]=  1.29
VALID DATA POINT #   7   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  26   LIMESTONE INJECTION

292  13:22:03   102.4 17119  3383  2276  2256  2280  2555   860  2070  2735  2617 21032      3383   860  9367  7423      0.20  0.25  0.79  1.23        4.0  40.0  14.8 320.0 540.0
                                                                                              159   576   576   493                                    0.0  49.4  18.3 395.3 667.1
  0    0.0      91.3          516   666   665   644   660   564   665   647   655               77    30    98   166                                    3.0  42.4  15.7 338.8 571.8
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  464 F   MILL OUT= 172 F   EXIT= 1525 F   EXIT(sp)= 1507 F   SMPL= 1212 F   SEC WB= 576 F   TER WB= 493 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  27   BASELINE STAGED

 24  14:37:22    99.2 16594  3343  2244  2255  2233  2534   848  2129  2755  2649 20991      3343   848  9266  7533      0.20  0.25  0.81  1.26        4.5  38.0  13.8 350.0 270.0
                                                                                              155   584   584   503                                    0.0  48.4  17.6 445.5 343.6
  0    0.0      91.3          522   674   673   654   674   564   675   658   669               76    30    98   170                                    3.0  41.5  15.1 381.8 294.5
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  470 F   MILL OUT= 161 F   EXIT= 1556 F   EXIT(sp)= 1505 F   SMPL= 1241 F   SEC WB= 584 F   TER WB= 503 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 381     SORBENT AIR FLOW=  202  SCFM   [Ca]/[S]=  2.79
VALID DATA POINT #   1   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  28   LIME INJECTION

 56  14:55:39   101.7 17000  3338  2297  2219  2245  2525   849  2139  2789  2606 21006      3338   849  9286  7534      0.20  0.25  0.79  1.24        4.1  38.0  14.2 330.0 500.0
                                                                                              156   584   584   502                                    0.0  47.2  17.6 410.1 621.3
  0    0.0      91.3          524   677   674   654   673   566   676   655   668               76    30    98   170                                    3.0  40.5  15.1 351.5 532.5
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H20     TER WINDBOX P= 2.80IN H20     FURNACE P= 0.35IN H20     COAL P= 2.00IN H20
MILL IN=  469 F   MILL OUT= 166 F   EXIT= 1562 F   EXIT(sp)= 1516 F   SMPL= 1240 F   SEC WB= 584 F   TER WB= 502 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  18   BASELINE STAGED
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DATE          :   02-22-84                                          TER DIA        :   8
SYSTEM        :   LWS                                               TER LOC        :   OUTER
BURNER        :   SSM-2                                             P.A.DES.       :   BL
FUEL          :   UTAH8                                             OIL CHECK      :   7.0

               LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER        PRIM  CORE   SEC  TOTAL        O2    CO   CO2    NO    SO2
PT#    TIME  MBTU/HR  TA                     FLOW SCFM                                                FLOW SCFM                     SR (CUM)                                MEASURED
  OIL          CALC  SCFM                                                                              TEMP (F)                                                        CORR TO 0% O2
(%)    LOAD    MEAS                          TEMP (F)                                            VELOCITY (FT/SEC)                                                 CORR TO 3% O2

374  12:14:23    97.9 16364  3301  3336  4016  3531  3795   912   465   506   596 20457         3301   912 14677  1567        0.20  0.26  1.15  1.25        4.3  35.0  14.2 610.0   0.0
                                                                                                 159   568   568   342                                       0.0  44.0  17.9 767.1   0.0
  0     0.0     97.0         553   655   650   632   645   531   593   548   595                  76    31   153    30                                       3.0  37.7  15.3 657.5   0.0
K-TRON=8500 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.20IN H20    TER WINDBOX P= 0.05IN H20    FURNACE P= 0.25IN H20    COAL P= 2.00IN H20
MILL IN=  500 F   MILL OUT= 173 F   EXIT= 1430 F   EXIT(sp)= 1074 F   SMPL= 1193 F   SEC WB= 568 F   TER WB= 342 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE  20   BASELINE-UNSTAGED

712  14:41:35    98.6 16485  3307  2184  2210  2197  2447   898  2227  2815  2566 20852         3307   898  9038  7609        0.20  0.26  0.80  1.26        4.5  40.0  13.8 315.0 460.0
                                                                                                 163   565   565   490                                       0.0  50.9  17.6 400.9 585.5
  0     0.0     97.0         530   668   668   640   663   540   672   650   660                  76    31    94   170                                       3.0  43.6  15.1 343.6 501.8
K-TRON=8500 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.20IN H20    TER WINDBOX P= 0.05IN H20    FURNACE P= 0.25IN H20    COAL P= 2.00IN H20
MILL IN=  477 F   MILL OUT= 177 F   EXIT= 1502 F   EXIT(sp)= ---- F   SMPL= 1201 F   SEC WB= 565 F   TER WB= 490 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  21   BASELINE STAGED

831  15:43:16    97.8 16361  3368  2117  2118  2142  2398   882  2139  2746  2544 20453         3368   882  8775  7429        0.21  0.26  0.80  1.25        4.3  45.0  13.8 305.0   0.0
                                                                                                 161   573   573   491                                       0.0  56.6  17.4 383.5   0.0
  0     0.0     99.3         536   671   672   642   666   559   676   652   664                  77    31    92   166                                       3.0  48.5  14.9 328.7   0.0
K-TRON=8700 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.20IN H20    TER WINDBOX P= 0.05IN H20    FURNACE P= 0.25IN H20    COAL P= 2.00IN H20
MILL IN=  487 F   MILL OUT= 174 F   EXIT= 1504 F   EXIT(sp)= 1496 F   SMPL= 1208 F   SEC WB= 573 F   TER WB= 491 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  22   BASELINE STAGED

855  15:52:26   101.3 16940  3332  3504  4175  3772  3884   877   457   487   565 21054         3332   877 15336  1509        0.20  0.25  1.15  1.24        4.2  40.0  13.6 630.0   0.0
                                                                                                 161   590   590   392                                       0.0  50.0  17.0 787.5   0.0
  0     0.0     99.3         544   669   666   644   660   546   632   575   626                  77    31   163    30                                       3.0  42.9  14.6 675.0   0.0
K-TRON=8700 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.20IN H20    TER WINDBOX P= 0.05IN H20    FURNACE P= 0.25IN H20    COAL P= 2.00IN H20
MILL IN=  490 F   MILL OUT= 169 F   EXIT= 1499 F   EXIT(sp)= 1482 F   SMPL= 1235 F   SEC WB= 590 F   TER WB= 392 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  23   BASELINE-UNSTAGED

951  16:36:37    71.8 12005  3224  2477  2209  2199  2601   739   395   464   440 14749         3224   739  9486  1300        0.27  0.33  1.12  1.23        4.0  35.0  13.6 390.0   0.0
                                                                                                 161   635   635   381                                       0.0  43.2  16.8 481.8   0.0
  0     0.0     74.2         490   741   733   706   730   602   658   607   667                  74    27   105    26                                       3.0  37.1  14.4 412.9   0.0
K-TRON=6500 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.20IN H20    TER WINDBOX P= 0.05IN H20    FURNACE P= 0.25IN H20    COAL P= 2.00IN H20
MILL IN=  431 F   MILL OUT= 173 F   EXIT= 1388 F   EXIT(sp)= 1409 F   SMPL= 1071 F   SEC WB= 635 F   TER WB= 381 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  24   REDUCED LOAD

998  17:06:54    75.6 12645  3259  2361  1956  1961  2434   731  1039   967   959 15667         3259   731  8712  2965        0.26  0.32  1.00  1.24        4.1  42.0  14.2 355.2 487.6
                                                                                                 161   547   547   397                                       0.0  52.3  17.7 442.6 607.5
  0     0.0     74.2         453   645   639   616   639   515   632   598   614                  75    25    89    60                                       3.0  44.9  15.2 379.4 520.8
K-TRON=6500 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.20IN H20    TER WINDBOX P= 0.05IN H20    FURNACE P= 0.25IN H20    COAL P= 2.00IN H20
MILL IN=  408 F   MILL OUT= 182 F   EXIT= 1385 F   EXIT(sp)= 1381 F   SMPL= 1099 F   SEC WB= 547 F   TER WB= 397 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  25   REDUCED LOAD

---  17:25:21    71.1 11893  3289  1731  1171  1391  1806   778  1382  1404  1576 14528         3289   778  6099  4362        0.28  0.34  0.85  1.22        3.9  45.0  14.6 285.0 500.0
                                                                                                 160   518   518   429                                       0.0  55.3  17.9 350.0 614.0
  0     0.0     74.2         474   626   615   590   618   520   622   596   609                  75    25    60    91                                       3.0  47.4  15.4 300.0 526.3
K-TRON=6500 LBS/HR     CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.70IN H20    TER WINDBOX P= 0.40IN H20    FURNACE P= 0.08IN H20    COAL P= 2.00IN H20
MILL IN=  428 F   MILL OUT= 175 F   EXIT= 1375 F   EXIT(sp)= 1401 F   SMPL= 1059 F   SEC WB= 518 F   TER WB= 429 F        SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  26   STAGING CURVE
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DATE          :    02-22-84                           TER DIA       :    8
SYSTEM        :    LWS                                TER LOC       :    OUTER
BURNER        :    SSM-2                              P.A.DES.      :    BL
FUEL          :    UTAH8                              OIL CHECK     :    7.0
-----------------------------------------------------------------------------------------------------------------------------------------
                 LOAD           PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL       PRIM  CORE  SEC   TER       PRIM  CORE  SEC   TOTAL       O2    CO    CO2   NO    SO2
PT#    TIME   MBTU/HR  TA                        FLOW SCFM                                              FLOW SCFM                     SR (CUM)                          MEASURED
  OIL            CALC  SCFM                                                                             TEMP (F)                                                      CORR TO 0% O2
(%)    LOAD      MEAS                            TEMP (F)                                          VELOCITY (FT/SEC)                                                  CORR TO 3% O2
-----------------------------------------------------------------------------------------------------------------------------------------

---  17:35:48   73.2  12238  3212  1586  1079  1319  1667   757  1767  1015  2098  15299       3212   757  5651  5680      0.26  0.32  0.79  1.25        4.3  50.0  14.4  265.0  500.0
                                                                                                160   507   507   447                                  0.0  62.9  18.1  333.2  620.7
 0     0.0    74.2          506   621   610   583   613   515   623   599   612                   74    24    55   121                                  3.0  53.9  15.5  285.6  538.9
K-TRON=6500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.70IN H2O    TER WINDBOX P= 0.40IN H2O    FURNACE P= 0.08IN H2O    COAL P= 2.00IN H2O
MILL IN=  449 F   MILL OUT= 173 F   EXIT= 1409 F   EXIT(sp)= 1416 F   SMPL= 1079 F   SEC WB= 507 F   TER WB= 447 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  27   STAGING CURVE

---  18:10:23   51.4   8591  3431  1447  1142  1266  1582   580   484   450   296  10677       3431   580  5437  1229      0.40  0.47  1.10  1.24        4.2  45.0  14.6  360.0    0.0
                                                                                                161   600   600   352                                  0.0  56.3  18.3  450.0    0.0
 0     0.0    54.8          377   735   723   674   716   582   673   584   641                   79    21    58    23                                  3.0  48.2  15.6  385.7    0.0
K-TRON=4800 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.70IN H2O    TER WINDBOX P= 0.40IN H2O    FURNACE P= 0.08IN H2O    COAL P= 2.00IN H2O
MILL IN=  337 F   MILL OUT= 178 F   EXIT= 1232 F   EXIT(sp)= 1245 F   SMPL=  935 F   SEC WB= 600 F   TER WB= 352 F          SORBENT LBS/HR= 0.00    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  28   STAGING CURVE
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DATE          :   02-23-84                       TER DIA      :   8
SYSTEM        :   LWS                            TER LOC      :   OUTER
BURNER        :   SSM-2                          P.A.DES.     :   BL
FUEL          :   UTAH8                          OIL CHECK    :   7.15

                    LOAD            PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL       PRIM  CORE   SEC   TER      PRIM  CORE   SEC  TOTAL       02    CO   C02    NO   S02
PT#    TIME   MBTU/HR  TA                               FLOW SCFM                                          FLOW SCFM                      SR (CUM)                          MEASURED
  OIL           CALC  SCFM                                                                                  TEMP (F)                                                    CORR TO 0% 02
(%)    LOAD     MEAS                                    TEMP (F)                                        VELOCITY (FT/SEC)                                                CORR TO 3% 02

201  12:16:46   99.5 16642  3299  3822  3902  3845  4332  1033   226   315   276 21051        3299  1033 15901   817     0.20  0.26  1.22  1.26      4.5  35.0  14.4 650.0 500.0
                                                                                               163   576   576   352                                 0.0  44.5  18.3 827.3 636.4
  0    0.0     97.0          597   646   640   627   641   568   577   543   591                76    36   167    16                                 3.0  38.2  15.7 709.1 545.5
K-TRON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.00IN H20    TER WINDBOX P= 0.20IN H20    FURNACE P= 0.01IN H20    COAL P= 1.40IN H20
MILL IN=  539 F   MILL OUT= 177 F   EXIT= 1555 F   EXIT(sp)= 1725 F   SMPL= 1242 F   SEC WB= 576 F   TER WB= 352 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  29   BASELINE-UNSTAGED

265  12:45:48   99.5 16641  3295  2334  1762  2443  2412   920  2419  2540  2438 20563        3295   920  8951  7397     0.20  0.25  0.79  1.24      4.1  37.0  14.6 290.0 560.0
                                                                                               163   543   543   468                                 0.0  46.0  18.1 360.4 695.9
  0    0.0     97.0          574   639   634   619   633   530   636   614   625                76    31    91   161                                 3.0  39.4  15.6 308.9 596.4
K-TRON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.50IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  537 F   MILL OUT= 170 F   EXIT= 1522 F   EXIT(sp)= 1025 F   SMPL= 1197 F   SEC WB= 543 F   TER WB= 468 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE  30   BASELINE-UNSTAGED

309  13:08:48  100.4 16781  3087  2392  2071  2554  2561   893  2461  2581  2502 21102        3087   893  9578  7545     0.18  0.24  0.81  1.26      4.4  35.0  14.2 335.0 320.0
                                                                                               163   559   559   478                                 0.0  44.3  18.0 423.8 404.8
  0    0.0     95.8          602   646   641   627   642   549   644   627   635                71    30    99   166                                 3.0  38.0  15.4 363.3 347.0
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.50IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  541 F   MILL OUT= 173 F   EXIT= 1542 F   EXIT(sp)= 1055 F   SMPL= 1234 F   SEC WB= 559 F   TER WB= 478 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 498    SORBENT AIR FLOW=  204  SCFM   [Ca]/[S]=  2.69
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  29   LIMESTONE INJECTION

324  13:22:48  100.9 16864  3258  2376  2056  2551  2560   890  2451  2572  2494 21207        3258   890  9543  7516     0.19  0.25  0.81  1.26      4.4  35.0  14.2 320.0 490.0
                                                                                               163   557   557   478                                 0.0  44.3  18.0 404.8 619.9
  0    0.0     95.8          556   646   642   628   644   539   645   627   634                75    30    90   166                                 3.0  38.0  15.4 347.0 531.3
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.50IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  479 F   MILL OUT= 170 F   EXIT= 1546 F   EXIT(sp)= 1702 F   SMPL= 1227 F   SEC WB= 557 F   TER WB= 478 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  33   BASELINE

334  13:29:03  101.6 16983  3291  2367  2089  2541  2566   891  2441  2564  2481 21231        3291   891  9564  7486     0.19  0.25  0.81  1.25      4.3  35.0  14.2 315.0 500.0
                                                                                               164   560   560   479                                 0.0  44.0  17.9 396.1 628.7
  0    0.0     95.8          567   647   644   630   645   541   647   627   635                76    30    99   165                                 3.0  37.7  15.3 339.5 538.9
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.50IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  530 F   MILL OUT= 182 F   EXIT= 1531 F   EXIT(sp)= 1703 F   SMPL= 1226 F   SEC WB= 560 F   TER WB= 479 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   4   RECORD ON TRK   1   FILE  34   BASELINE

370  13:42:03  101.3 16942  3184  2444  1983  2616  2547   899  2511  2595  2527 21305        3184   899  9509  7633     0.19  0.24  0.81  1.26      4.4  35.0  14.4 315.0 350.0
                                                                                               162   556   556   475                                 0.0  44.3  18.2 398.5 442.8
  0    0.0     95.8          560   646   640   624   638   524   644   617   633                73    31    99   168                                 3.0  38.0  15.6 341.6 379.5
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.50IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  501 F   MILL OUT= 176 F   EXIT= 1554 F   EXIT(sp)= 1706 F   SMPL= 1248 F   SEC WB= 556 F   TER WB= 475 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 368    SORBENT AIR FLOW=  199  SCFM   [Ca]/[S]=  1.97
VALID DATA POINT #   6   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  30   LIMESTONE INJECTION

408  14:02:24  101.1 16903  3201  2417  2026  2564  2570   892  2451  2590  2543 21256        3201   892  9578  7585     0.19  0.24  0.81  1.26      4.4  40.0  14.6 300.0 400.0
                                                                                               163   558   558   480                                 0.0  50.6  18.5 379.5 506.0
  0    0.0     95.8          578   653   647   635   650   530   651   633   641                74    30    99   168                                 3.0  43.4  15.8 325.3 433.7
K-TRON=8400 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.50IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  531 F   MILL OUT= 170 F   EXIT= 1535 F   EXIT(sp)= 1544 F   SMPL= 1240 F   SEC WB= 558 F   TER WB= 480 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 179    SORBENT AIR FLOW=  200  SCFM   [Ca]/[S]=  0.96
VALID DATA POINT #   7   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  31   LIMESTONE INJECTION
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DATE            :    02-23-84                              TER DIA       :    8
SYSTEM          :    LWS                                   TER LOC       :    OUTER
BURNER          :    SSM-2                                 P.A.DES.      :    BL
FUEL            :    UTAH8                                 OIL CHECK     :    7.15

                  LOAD     PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE  SEC   TER        PRIM  CORE  SEC   TOTAL        O2    CO    CO2    NO     SO2
PT#      TIME   MBTU/HR  TA                       FLOW SCFM                                          FLOW SCFM                    SR (CUM)                                 MEASURED
  OIL            CALC   SCFM                                                                          TEMP (F)                                                        CORR TO 0% O2
(%)      LOAD    MEAS                              TEMP (F)                                       VELOCITY (FT/SEC)                                                   CORR TO 3% O2

444  14:20:28   100.0 16725  3290  2465  2042  2554  2537   894  2436  2564  2500  21282        3290   894  9599  7500       0.20  0.25  0.82  1.27         4.6   40.0  14.6  315.0  400.0
                                                                                                 163   560   560   481                                       0.0   51.2  18.7  403.4  614.6
  0      0.0     95.0         568   660   654   639   654   539   660   636   647                 76    30    99   166                                       3.0   43.9  16.0  345.7  526.8
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.03IN H20     COAL P= 1.50IN H20
MILL IN=  525 F   MILL OUT= 183 F   EXIT= 1525 F   EXIT(sp)= 1511 F   SMPL= 1230 F   SEC WB= 560 F   TER WB= 481 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  37   BASELINE

509  14:50:55    97.3 16265  3373  2302  1876  2447  2478   909  2342  2519  2450  20697        3373   909  9104  7311       0.21  0.26  0.82  1.27         4.6   37.0  14.2  305.0  500.0
                                                                                                 164   575   575   490                                       0.0   47.4  18.2  390.5  640.2
  0      0.0     95.0         543   667   660   644   654   562   668   646   655                 78    31    95   163                                       3.0   40.6  15.6  334.0  548.0
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.03IN H20     COAL P= 1.50IN H20
MILL IN=  511 F   MILL OUT= 171 F   EXIT= 1512 F   EXIT(sp)= 1485 F   SMPL= 1233 F   SEC WB= 575 F   TER WB= 490 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  38   BASELINE

606  15:34:57    98.7 16512  3346  2251  1700  2390  2337   918  2331  2490  2398  20170        3346   918  8686  7220       0.20  0.26  0.78  1.22         3.9   45.0  14.8  280.0  160.0
                                                                                                 163   574   574   495                                       0.0   55.3  18.2  343.9  196.5
  0      0.0     95.8         540   668   664   649   662   567   673   640   659                 77    32    91   162                                       3.0   47.4  15.6  294.7  160.4
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.03IN H20     COAL P= 1.50IN H20
MILL IN=  512 F   MILL OUT= 174 F   EXIT= 1514 F   EXIT(sp)= 1480 F   SMPL= 1243 F   SEC WB= 574 F   TER WB= 495 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 431    SORBENT AIR FLOW=  246  SCFM   [Ca]/[S]=  3.10
VALID DATA POINT #  10   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  32   LIME INJECTION

619  15:46:23    97.7 16334  3370  2300  1814  2306  2303   921  2353  2506  2419  20301        3370   921  8731  7270       0.21  0.26  0.80  1.24         4.2   42.0  14.6  280.0  530.0
                                                                                                 164   562   562   494                                       0.0   52.5  18.3  350.0  662.5
  0      0.0     95.8         534   670   666   649   662   549   676   650   660                 78    32    90   163                                       3.0   45.0  15.6  300.0  567.9
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.03IN H20     COAL P= 1.50IN H20
MILL IN=  507 F   MILL OUT= 172 F   EXIT= 1493 F   EXIT(sp)= 1479 F   SMPL= 1239 F   SEC WB= 562 F   TER WB= 494 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  40   BASELINE

704  16:28:13    98.5 16462  3328  2240  1887  2380  2416   900  2454  2668  2544  20824        3328   900  8930  7666       0.20  0.26  0.80  1.26         4.5   40.0  14.2  290.0  360.0
                                                                                                 164   582   582   501                                       0.0   50.9  18.1  369.1  458.2
  0      0.0     95.8         537   672   666   650   666   582   674   655   663                 77    31    94   173                                       3.0   43.6  15.5  316.4  392.7
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.03IN H20     COAL P= 1.50IN H20
MILL IN=  489 F   MILL OUT= 177 F   EXIT= 1547 F   EXIT(sp)= 1566 F   SMPL= 1259 F   SEC WB= 582 F   TER WB= 501 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 218    SORBENT AIR FLOW=  135  SCFM   [Ca]/[S]=  1.61
VALID DATA POINT #  12   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  33   LIME INJECTION-LOW VELOCITY INJECTION

805  17:16:24    99.4 16618  3386  2244  1709  2335  2287   909  2495  2683  2607  20654        3386   909  8574  7785       0.20  0.26  0.77  1.24         4.2   40.0  14.6  270.0  220.0
                                                                                                 164   593   593   509                                       0.0   50.0  18.3  337.5  275.0
  0      0.0     95.8         516   669   668   652   672   595   673   657   664                 78    32    91   177                                       3.0   42.9  15.6  289.3  235.7
K-TRON=8400 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 1.50IN H20     TER WINDBOX P= 2.00IN H20     FURNACE P= 0.03IN H20     COAL P= 1.50IN H20
MILL IN=  400 F   MILL OUT= 176 F   EXIT= 1570 F   EXIT(sp)= 1571 F   SMPL= 1256 F   SEC WB= 593 F   TER WB= 509 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 134    SORBENT AIR FLOW=  239  SCFM   [Ca]/[S]=  0.98
VALID DATA POINT #  13   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  34   LIME INJECTION
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DATE          :   02-24-84                         TER DIA      :   8
SYSTEM        :   LWS                              TER LOC      :   OUTER
BURNER        :   SSM-2                            P.A.DES.     :   BL
FUEL          :   UTAH8                            OIL CHECK    :   6.68
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                LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE   SEC   TER     PRIM  CORE   SEC  TOTAL      O2    CO    CO2    NO     SO2
PT#    TIME    MBTU/HR  TA                      FLOW SCFM                                        FLOW SCFM                     SR (CUM)                           MEASURED
  OIL           CALC  SCFM                                                                        TEMP (F)                                                      CORR TO 0% O2
(%)    LOAD     MEAS                            TEMP (F)                                     VELOCITY (FT/SEC)                                                  CORR TO 3% O2
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284  10:34:54   100.2 16752  3300  4337  3428  4349  3653   906   293   265   411  20943      3300   906 15767   970     0.20  0.25  1.19  1.25      4.3   35.0  14.2  635.0  500.0
                                                                                             163   582   582   371                                 0.0   44.0  17.9  798.5  628.7
  0     0.0      97.0        578   650   645   638   642   554   592   558   603               76    32   166    19                                 3.0   37.7  15.3  684.4  538.1
K-TKON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 6.20IN H20   TER WINDBOX P= 0.10IN H20   FURNACE P= 0.01IN H20   COAL P= 0.50IN H20
MILL IN=  523 F   MILL OUT= 175 F   EXIT= 1540 F   EXIT(sp)=  325 F   SMPL= 1237 F   SEC WB= 582 F   TER WB= 371 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  43   BASELINE-UNSTAGED

348  11:00:42    99.7 16668  3431  2306  1975  2173  2210   934  2514  2448  2606  20596      3431   934  8663  7567     0.21  0.26  0.78  1.24      4.1   30.0  14.0  305.0  540.0
                                                                                             164   548   548   474                                 0.0   37.3  17.4  379.0  671.0
  0     0.0      97.0        520   642   640   628   638   534   641   627   638               79    31    88   166                                 3.0   32.0  14.9  324.9  575.1
K-TKON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 2.10IN H20   TER WINDBOX P= 2.80IN H20   FURNACE P= 0.02IN H20   COAL P= 0.50IN H20
MILL IN=  472 F   MILL OUT= 172 F   EXIT= 1511 F   EXIT(sp)=  306 F   SMPL= 1199 F   SEC WB= 548 F   TER WB= 474 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  44   BASELINE-STAGED

359  11:14:45    99.1 16567  3293  2436  2106  2282  2346   927  2449  2447  2547  20833      3293   927  9170  7443     0.20  0.25  0.81  1.26      4.4   30.0  13.6  315.0  500.0
                                                                                             162   560   560   480                                 0.0   38.0  17.2  398.5  632.5
  0     0.0      97.0        553   646   645   633   644   545   649   632   646               76    32    95   164                                 3.0   32.5  14.7  341.6  542.2
K-TKON=8500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %   SEC WINDBOX P= 2.10IN H20   TER WINDBOX P= 2.80IN H20   FURNACE P= 0.02IN H20   COAL P= 0.50IN H20
MILL IN=  501 F   MILL OUT= 171 F   EXIT= 1525 F   EXIT(sp)=  333 F   SMPL= 1221 F   SEC WB= 560 F   TER WB= 480 F          SORBENT LBS/HR= 0.00   SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  45   BASELINE-STAGED
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DATE            :  02-24-84                    TER DIA      :  8
SYSTEM          :  LWS                         TER LOC      :  OUTER
BURNER          :  SSM-2                       P.A.DES.     :  BL
FUEL            :  INDIANA4                    OIL CHECK    :  6.68

                 LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER       PRIM  CORE  SEC  TOTAL      02    CO    CO2   NO    SO2
PT#     TIME   MBTU/HR  TA                          FLOW SCFM                                       FLOW SCFM                 SR (CUM)                              MEASURED
   OIL          CALC   SCFM                                                                         TEMP (F)                                                      CORR TO 0% O2
(%)     LOAD    MEAS                                TEMP (F)                                     VELOCITY (FT/SEC)                                                CORR TO 3% O2

670  13:18:09   99.8 16766  3375  2413  2074  2295  2305   906  2469  2542  2615  20995      3375   906  9087  7626      0.20  0.26  0.80  1.25     4.3   40.0  14.8  395.0  930.0
                                                                                               138   567   567   486                                  0.0   50.3  18.6  496.7 1169.5
                                                                                                75    31    95   169                                  3.0   43.1  16.0  425.7 1002.4
 0      0.0     97.9           578   660   654   639   651   565   655   639   647
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  524 F   MILL OUT= 138 F   EXIT= 1560 F   EXIT(sp)=  340 F   SMPL= 1259 F   SEC WB= 567 F   TER WB= 486 F           SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE  48   INDIANA BASELINE

803  14:28:31   98.4 16524  3128  2482  2107  2296  2314   921  2364  2449  2511  20571      3128   921  9199  7323      0.19  0.24  0.80  1.24     4.2   40.0  15.2  400.0  740.0
                                                                                               144   555   555   485                                  0.0   50.0  19.0  500.0  925.0
                                                                                                70    31    95   162                                  3.0   42.9  16.3  428.6  792.9
 0      0.0     97.9           744   658   654   639   652   542   654   638   647
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  672 F   MILL OUT= 144 F   EXIT= 1567 F   EXIT(sp)=  344 F   SMPL= 1269 F   SEC WB= 555 F   TER WB= 485 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 800    SORBENT AIR FLOW=  250  SCFM   [Ca]/[S]=  2.03
VALID DATA POINT #   5   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  49   LIMESTONE INJECTION-TERTS

820  14:40:11  101.7 17082  3121  2502  2124  2313  2313   922  2393  2455  2517  20660      3121   922  9253  7365      0.18  0.24  0.78  1.21     3.7   45.0  15.6  390.0  970.0
                                                                                               144   556   556   483                                  0.0   54.6  18.9  473.4 1177.5
                                                                                                70    31    95   163                                  3.0   46.8  16.2  405.8 1009.2
 0      0.0     97.9           752   657   654   639   652   541   654   638   645
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  681 F   MILL OUT= 144 F   EXIT= 1596 F   EXIT(sp)=  345 F   SMPL= 1280 F   SEC WB= 556 F   TER WB= 483 F           SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  50   BASELINE

875  15:06:42  101.2 17001  3055  2553  2218  2446  2422   909  2529  2564  2594  21289      3055   909  9638  7688      0.18  0.23  0.80  1.25     4.3   40.0  15.2  420.0  590.0
                                                                                               146   553   553   478                                  0.0   50.3  19.1  528.1  741.9
                                                                                                68    31    99   169                                  3.0   43.1  16.4  452.7  635.9
 0      0.0     97.9           762   643   641   628   640   534   641   628   638
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  688 F   MILL OUT= 138 F   EXIT= 1600 F   EXIT(sp)=  348 F   SMPL= 1305 F   SEC WB= 553 F   TER WB= 478 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 941    SORBENT AIR FLOW=  195  SCFM   [Ca]/[S]=  2.33
VALID DATA POINT #   7   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  35   LIMESTONE INJECTION

950  15:41:17   98.6 16568  3161  2406  1798  2155  2179   925  2626  2716  2782  20747      3161   925  8537  8124      0.19  0.25  0.76  1.25     4.3   38.0  15.2  365.0  640.0
                                                                                               149   538   538   475                                  0.0   47.8  19.1  459.0  804.8
                                                                                                71    31    86   178                                  3.0   41.0  16.4  393.4  689.8
 0      0.0     97.9           751   638   636   622   634   525   638   625   636
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  679 F   MILL OUT= 145 F   EXIT= 1556 F   EXIT(sp)=  340 F   SMPL= 1286 F   SEC WB= 538 F   TER WB= 475 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 740    SORBENT AIR FLOW=  195  SCFM   [Ca]/[S]=  1.88
VALID DATA POINT #   8   ELAPSED TIME, MIN  10   RECORD ON TRK   0   FILE  36   LIMESTONE INJECTION

961  15:51:34   98.7 16575  3145  2289  1887  2131  2146   927  2669  2705  2735  20634      3145   927  8453  8109      0.19  0.25  0.76  1.24     4.2   38.0  14.8  365.0  930.0
                                                                                               148   539   539   482                                  0.0   47.5  18.5  456.3 1162.5
                                                                                                71    31    86   179                                  3.0   40.7  15.9  391.1  996.4
 0      0.0     97.9           752   649   646   631   643   529   648   632   644
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  681 F   MILL OUT= 136 F   EXIT= 1572 F   EXIT(sp)=  341 F   SMPL= 1287 F   SEC WB= 539 F   TER WB= 482 F           SORBENT LBS/HR=   0    SORBENY AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  53   BASELINE

---  16:24:48  100.8 16926  3156  2540  2221  2328  2363   906  2637  2685  2739  21577      3156   906  9453  8062      0.19  0.24  0.80  1.27     4.6   40.0  14.2  410.0  980.0
                                                                                               145   559   559   488                                  0.0   51.2  18.2  525.0 1254.9
                                                                                                71    31    98   180                                  3.0   43.9  15.6  450.0 1075.6
 0      0.0     97.9           745   657   656   642   653   540   655   640   651
K-TRON=9300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  698 F   MILL OUT= 148 F   EXIT= 1572 F   EXIT(sp)=  336 F   SMPL= 1282 F   SEC WB= 559 F   TER WB= 488 F           SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  54   BASELINE
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DATE           :    02-24-84                       TER DIA       :    8
SYSTEM         :    LWS                            TER LOC       :    OUTER
BURNER         :    SSM-2                          P.A.DES.      :    BL
FUEL           :    INDIANA4                       OIL CHECK     :    6.68
----------------------------------------------------------------------------------------------------------------------------------------------
                  LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL      O2    CO    CO2    NO     SO2
PT#      TIME   MBTU/HR  TA                           FLOW SCFM                                      FLOW SCFM                  SR (CUM)                        MEASURED
  OIL           CALC   SCFM                                                                          TEMP (F)                                                CORR TO 0% O2
(%)    LOAD     MEAS                                  TEMP (F)                                  VELOCITY (FT/SEC)                                            CORR TO 3% O2
----------------------------------------------------------------------------------------------------------------------------------------------

--- 16:47:26  100.0 16801  3223  2509  1965  2333  2303   921  2490  2637  2533 20915     3223   921  9109  7661     0.19  0.25  0.79  1.24      4.2  35.0  15.0  400.0  580.0
                                                                                          149   551   551   480                                  0.0  43.8  18.8  500.0  725.0
  0     0.0     97.9          747   641   639   628   638   549   638   625   633              73    31    93   169                                  3.0  37.5  16.1  428.6  621.4
K-TRON=9300 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  697 F   MILL OUT= 134 F   EXIT= 1580 F   EXIT(sp)=  357 F   SMPL= 1313 F   SEC WB= 551 F   TER WB= 480 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 760    SORBENT AIR FLOW=  193  SCFM   [Ca]/[S]=  1.90
VALID DATA POINT #  11   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  37   LIMESTONE INJECTION

--- 16:57:21  100.6 16900  3199  2477  1979  2310  2304   921  2432  2628  2545 20795     3199   921  9070  7606     0.19  0.24  0.78  1.23      4.0  40.0  14.6  390.0  860.0
                                                                                          148   560   560   486                                  0.0  49.4  18.0  481.8 1062.4
  0     0.0     97.9          752   647   645   633   644   551   645   631   640              72    31    94   169                                  3.0  42.4  15.5  412.9  910.6
K-TRON=9300 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.40IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.02IN H20    COAL P= 0.60IN H20
MILL IN=  710 F   MILL OUT= 148 F   EXIT= 1578 F   EXIT(sp)=  363 F   SMPL= 1307 F   SEC WB= 560 F   TER WB= 486 F             SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  56   BASELINE
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DATE        :   02-28-84                                          TER DIA       :   8
SYSTEM      :   LWS                                               TER LOC       :   OUTER
BURNER      :   SSM-2                                             P.A.DES.      :   BL
FUEL        :   INDIANA4                                          OIL CHECK     :   6.45

             LOAD         PRIM   V -2   V -3   V -4   V -5  CORE   V -7   V -8   V -9  TOTAL      PRIM  CORE   SEC    TER       PRIM  CORE   SEC  TOTAL        O2    CO    CO2    NO    SO2
PT#    TIME  MBTU/HR  TA                              FLOW SCFM                                        FLOW SCFM                      SR (CUM)                              MEASURED
  OIL         CALC  SCFM                                                                                TEMP (F)                                                        CORR TO 0% O2
(%)   LOAD    MEAS                                   TEMP (F)                                      VELOCITY (FT/SEC)                                                    CORR TO 3% O2

259  09:10:03    99.4  16698   3132   3917   3898   3740   3742    928    707    303    420  20787      3132   928  15297   1430      0.19  0.24  1.16  1.24        4.2   40.0   15.2  675.0 1030.0
                                                                                                     156   587    587    375                                       0.0   50.0   19.0  843.8 1287.5
  0     0.0     95.8            830    646    631    629    639    577    614    555    595              71    33    162     28                                       3.0   42.9   16.3  723.2 1103.6
K-TRON=9100 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 6.00IN H20    TER WINDBOX P= 0.02IN H20    FURNACE P= 1.50IN H20    COAL P= 1.50IN H20
MILL IN=  755 F   MILL OUT= 153 F   EXIT= 1580 F   EXIT(sp)= 1655 F   SMPL= 1283 F   SEC WB= 587 F   TER WB= 375 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE  57   BASELINE-UNSTAGED

297  09:31:15   100.1  16813   3259   3106   2808   2856   2928    934   1632   1590   1694  20808      3259   934  11698   4917      0.19  0.25  0.95  1.24        4.1   40.0   15.4  535.0 1060.0
                                                                                                     157   575    575    454                                       0.0   49.7   19.1  664.8 1317.2
  0     0.0     96.8            775    647    630    629    639    563    631    610    620              74    32    123    106                                       3.0   42.6   16.4  569.8 1129.0
K-TRON=9200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.80IN H20    TER WINDBOX P= 1.00IN H20    FURNACE P= 0.03IN H20    COAL P= 1.50IN H20
MILL IN=  718 F   MILL OUT= 147 F   EXIT= 1564 F   EXIT(sp)= 1646 F   SMPL= 1268 F   SEC WB= 575 F   TER WB= 454 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   9   RECORD ON TRK   1   FILE  58   STAGING

316  09:39:42   101.1  16981   3205   3037   2483   2699   2749    932   2090   2008   2187  21390      3205   932  10968   6285      0.19  0.24  0.89  1.26        4.4   40.0   15.0  490.0  980.0
                                                                                                     156   557    557    460                                       0.0   50.6   19.0  619.9 1239.8
  0     0.0     96.8            775    640    624    623    636    533    630    610    620              73    32    113    136                                       3.0   43.4   16.3  531.3 1062.7
K-TRON=9200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.80IN H20    TER WINDBOX P= 1.80IN H20    FURNACE P= 0.04IN H20    COAL P= 1.00IN H20
MILL IN=  716 F   MILL OUT= 150 F   EXIT= 1557 F   EXIT(sp)= 1653 F   SMPL= 1271 F   SEC WB= 557 F   TER WB= 460 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  38   STAGING

362  09:58:17   101.8  17102   3238   2527   2236   2381   2445    929   2589   2487   2582  21415      3238   929   9589   7658      0.19  0.24  0.80  1.25        4.3   40.0   15.0  400.0 1040.0
                                                                                                     155   555    555    475                                       0.0   50.3   18.9  583.0 1307.8
  0     0.0     96.8            742    634    618    618    631    548    629    614    621              74    32     99    168                                       3.0   43.1   16.2  431.1 1121.0
K-TRON=9200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.50IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.05IN H20    COAL P= 1.00IN H20
MILL IN=  680 F   MILL OUT= 150 F   EXIT= 1550 F   EXIT(sp)= 1642 F   SMPL= 1262 F   SEC WB= 555 F   TER WB= 475 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE  60   BASELINE-STAGED

414  10:28:09   101.3  17019   3207   2174   1703   1984   2128    925   3073   3021   3097  21312      3207   925   7988   9191      0.19  0.24  0.71  1.25        4.3   40.0   15.0  330.0 1020.0
                                                                                                     154   539    539    481                                       0.0   50.3   18.9  415.0 1282.6
  0     0.0     96.8            725    630    616    616    627    535    631    616    623              73    31     81    203                                       3.0   43.1   16.2  355.7 1099.4
K-TRON=9200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.50IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.05IN H20    COAL P= 1.00IN H20
MILL IN=  674 F   MILL OUT= 158 F   EXIT= 1535 F   EXIT(sp)= 1635 F   SMPL= 1254 F   SEC WB= 539 F   TER WB= 481 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   5   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  61   STAGING  CURVE

430  10:41:01   101.9  17110   3227   1877   1324   1638   1799    923   3613   3514   3638  21552      3227   923   6638  10764      0.19  0.24  0.63  1.26        4.4   40.0   14.8  300.0 1020.0
                                                                                                     154   529    529    490                                       0.0   50.6   18.7  379.5 1290.4
  0     0.0     96.8            706    629    611    610    623    536    631    618    623              73    31     67    240                                       3.0   43.4   16.0  325.3 1106.0
K-TRON=9200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.50IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.05IN H20    COAL P= 1.00IN H20
MILL IN=  669 F   MILL OUT= 154 F   EXIT= 1515 F   EXIT(sp)= 1613 F   SMPL= 1253 F   SEC WB= 529 F   TER WB= 490 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  62   STAGING CURVE

470  10:57:04   100.4  16861   3234   2567   2205   2363   2441    916   2484   2474   2429  21114      3234   916   9576   7387      0.19  0.25  0.81  1.25        4.3   40.0   14.8  410.0  980.0
                                                                                                     153   552    552    472                                       0.0   50.3   18.6  515.6 1232.3
  0     0.0     96.8            719    633    617    618    628    552    628    612    618              73    31     98    162                                       3.0   43.1   16.0  441.9 1056.3
K-TRON=9200 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.50IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.05IN H20    COAL P= 1.00IN H20
MILL IN=  646 F   MILL OUT= 153 F   EXIT= 1577 F   EXIT(sp)= 1673 F   SMPL= 1274 F   SEC WB= 552 F   TER WB= 472 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  63   BASELINE-STAGED
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DATE       :   02-28-84                                TER DIA      :   8
SYSTEM     :   LWS                                     TER LOC      :   OUTER
BURNER     :   SSM-2                                   P.A.DES.     :   BL
FUEL       :   INDIANA4                                OIL CHECK    :   6.45

               LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE   SEC   TER     PRIM  CORE   SEC  TOTAL     O2    CO   CO2    NO    SO2
PT#    TIME  MBTU/HR  TA                            FLOW SCFM                                      FLOW SCFM                      SR (CUM)                           MEASURED
  OIL          CALC  SCFM                                                                           TEMP (F)                                                      CORR TO 0% O2
(%)    LOAD    MEAS                                  TEMP (F)                                  VELOCITY (FT/SEC)                                                  CORR TO 3% O2

495  11:07:50  100.4  16863  3302  2592  2196  2364  2447   914  2486  2498  2440  21241     3302   914  9600  7424     0.20  0.25  0.82  1.26     4.4  40.0  14.6  410.0  350.0
                                                                                              153   559   559   475                               0.0  50.6  18.5  518.7  442.8
  0    0.0    96.8          722   636   620   621   632   559   630   614   622                75    31    99   163                               3.0  43.4  15.8  444.6  379.5
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  654 F   MILL OUT= 158 F   EXIT= 1581 F   EXIT(sp)= 1671 F   SMPL= 1293 F   SEC WB= 559 F   TER WB= 475 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 530    SORBENT AIR FLOW=  103  SCFM   [Ca]/[S]=  1.77
VALID DATA POINT #   8   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  39   LINE INJECTION CURVEE

511  11:19:32  100.2  16840  3236  2568  2192  2334  2438   913  2459  2491  2455  21087     3236   913  9532  7405     0.19  0.25  0.81  1.25     4.3  40.0  14.8  400.0  920.0
                                                                                              154   552   552   475                               0.0  50.3  18.6  503.0 1156.9
  0    0.0    96.8          713   637   620   621   634   539   631   615   622                73    31    98   163                               3.0  43.1  16.0  431.1  991.6
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  658 F   MILL OUT= 158 F   EXIT= 1584 F   EXIT(sp)= 1690 F   SMPL= 1290 F   SEC WB= 552 F   TER WB= 475 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  65   BASELINE-STAGED

542  11:34:45   99.2  16666  3264  2588  2195  2322  2436   910  2464  2485  2454  21119     3264   910  9542  7403     0.20  0.25  0.82  1.27     4.5  40.0  14.6  400.0  930.0
                                                                                              154   563   563   477                               0.0  50.9  18.6  509.1 1183.6
  0    0.0    96.8          703   635   620   621   633   563   631   615   622                74    31    99   163                               3.0  43.6  15.9  436.4 1014.5
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  652 F   MILL OUT= 150 F   EXIT= 1563 F   EXIT(sp)= 1667 F   SMPL= 1284 F   SEC WB= 563 F   TER WB= 477 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  10   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  66   BASELINE-STAGED

565  11:47:51   99.4  16699  3244  2590  2184  2295  2430   909  2468  2489  2426  21035     3244   909  9500  7382     0.19  0.25  0.82  1.26     4.4  45.0  14.6  405.0  690.0
                                                                                              152   560   560   472                               0.0  56.9  18.5  512.3  872.9
  0    0.0    96.8          691   635   619   620   631   563   631   613   621                73    31    98   162                               3.0  48.8  15.8  439.2  748.2
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  649 F   MILL OUT= 152 F   EXIT= 1599 F   EXIT(sp)= 1704 F   SMPL= 1298 F   SEC WB= 560 F   TER WB= 472 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 248    SORBENT AIR FLOW=  103  SCFM   [Ca]/[S]=  0.84
VALID DATA POINT #  11   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  40   LINE INJECTION CURVE

841  13:49:34   99.7  16752  3124  2508  2148  2317  2414   911  2552  2588  2539  21101     3124   911  9387  7680     0.19  0.24  0.80  1.26     4.4  40.0  14.4  395.0 1000.0
                                                                                              152   543   543   472                               0.0  50.6  18.2  499.7 1265.1
  0    0.0    96.8          814   631   611   612   625   530   629   610   619                71    31    95   168                               3.0  43.4  15.6  428.3 1084.3
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  747 F   MILL OUT= 157 F   EXIT= 1574 F   EXIT(sp)= 1550 F   SMPL= 1291 F   SEC WB= 543 F   TER WB= 472 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  68   BASELINE-STAGED

875  14:06:57   98.8  16599  3233  2501  2055  2319  2352   917  2527  2588  2418  20908     3233   917  9226  7532     0.19  0.25  0.81  1.26     4.4  40.0  14.4  410.0  540.0
                                                                                              154   549   549   469                               0.0  50.6  18.2  518.7  683.1
  0    0.0    96.8          759   628   606   609   621   550   626   609   615                73    31    94   164                               3.0  43.4  15.6  444.6  585.5
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  698 F   MILL OUT= 159 F   EXIT= 1589 F   EXIT(sp)= 1554 F   SMPL= 1315 F   SEC WB= 549 F   TER WB= 469 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 542    SORBENT AIR FLOW=  103  SCFM   [Ca]/[S]=  1.84
VALID DATA POINT #  13   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  41   LINE INJECTION CURVE

889  14:15:13   97.5  16381  3210  2487  2067  2297  2345   919  2466  2547  2419  20757     3210   919  9196  7433     0.20  0.25  0.81  1.27     4.5  40.0  14.4  410.0  920.0
                                                                                              153   546   546   466                               0.0  50.9  18.3  521.8 1170.9
  0    0.0    96.8          796   630   608   610   625   531   627   608   617                73    31    94   162                               3.0  43.6  15.7  447.3 1003.6
K-TRON=9200 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.50IN H2O     TER WINDBOX P= 2.80IN H2O     FURNACE P= 0.05IN H2O     COAL P= 1.00IN H2O
MILL IN=  732 F   MILL OUT= 157 F   EXIT= 1583 F   EXIT(sp)= 1549 F   SMPL= 1302 F   SEC WB= 546 F   TER WB= 466 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  14   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  42   BASELINE STAGED
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DATE           :     02-29-84                           TER DIA        :    8
SYSTEM         :     LWS                                TER LOC        :    OUTER
BURNER         :     SSM-2                              P.A.DES.       :    BL
FUEL           :     INDIANA4                           OIL CHECK      :    5.88

                 LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER       PRIM  CORE  SEC  TOTAL       O2    CO    CO2    NO    SO2
PT#    TIME    MBTU/HR  TA                          FLOW SCFM                                        FLOW SCFM                      SR (CUM)                            MEASURED
  OIL           CALC  SCFM                                                                            TEMP (F)                                                        CORR TO 0% O2
(%)    LOAD     MEAS                                  TEMP (F)                                   VELOCITY (FT/SEC)                                                    CORR TO 3% O2

287  11:51:14   97.9 16450  3333  3924  4130  3723  3772   899   246   256   562 20845      3333   899 15549  1064      0.20  0.26  1.20  1.27       4.5  40.0  14.4  635.0  920.0
                                                                                             153   565   565   342                                  0.0  50.9  18.3  808.2 1170.9
  0     0.0     94.7         754   635   621   619   631   531   573   540   586              76    31   161    20                                  3.0  43.6  15.7  692.7 1003.6
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 5.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  686 F   MILL OUT= 157 F   EXIT= 1571 F   EXIT(sp)= 1619 F   SMPL= 1296 F   SEC WB= 565 F   TER WB= 342 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  71   BASELINE UNSTAGED

379  12:33:51   99.6 16720  3298  2483  2139  2216  2380   880  2320  2551  2805 21072      3298   880  9218  7675      0.20  0.25  0.80  1.26       4.4  45.0  14.4  380.0  950.0
                                                                                             155   539   539   463                                  0.0  56.9  18.2  480.7 1201.8
  0     0.0     94.7         732   629   610   606   622   522   626   604   617              75    29    93   166                                  3.0  48.8  15.6  412.0 1030.1
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  665 F   MILL OUT= 160 F   EXIT= 1549 F   EXIT(sp)= 1654 F   SMPL= 1275 F   SEC WB= 539 F   TER WB= 463 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  72   BASELINE-STAGED

397  12:41:51   99.8 16758  3356  2457  2170  2185  2378   886  2301  2543  2833 21109      3356   886  9189  7677      0.20  0.25  0.80  1.26       4.4  45.0  14.4  395.0  430.0
                                                                                             153   546   546   467                                  0.0  56.9  18.2  499.7  544.0
  0     0.0     94.7         746   628   609   606   621   547   624   605   617              76    30    94   167                                  3.0  48.8  15.6  428.3  466.3
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  675 F   MILL OUT= 158 F   EXIT= 1559 F   EXIT(sp)= 1660 F   SMPL= 1289 F   SEC WB= 546 F   TER WB= 467 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 676     SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  2.27
VALID DATA POINT #   3   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  73   LIME  INJECTION CURVE

436  13:02:31   99.2 16656  3279  2417  2046  2201  2314   886  2274  2544  2775 20735      3279   886  8977  7593      0.20  0.25  0.79  1.24       4.2  45.0  15.0  385.0  910.0
                                                                                             154   549   549   471                                  0.0  56.3  18.8  481.3 1137.5
  0     0.0     94.7         764   636   615   614   630   541   632   617   625              74    30    92   166                                  3.0  48.2  16.1  412.5  975.0
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  694 F   MILL OUT= 145 F   EXIT= 1561 F   EXIT(sp)= 1669 F   SMPL= 1284 F   SEC WB= 549 F   TER WB= 471 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   4   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  74   BASELINE-STAGED

476  13:16:04   99.9 16783  2932  2143  2173  2193  2346   884  2279  2643  2940 20532      2932   884  8855  7861      0.17  0.23  0.75  1.22       3.9  38.0  15.2  380.0  370.0
                                                                                             155   557   557   477                                  0.0  46.7  18.7  466.7  454.4
  0     0.0     94.7        1016   911   618   618   633   553   633   619   627              67    30    91   173                                  3.0  40.0  16.0  400.0  389.5
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  706 F   MILL OUT= 156 F   EXIT= 1598 F   EXIT(sp)= 1699 F   SMPL= 1330 F   SEC WB= 557 F   TER WB= 477 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 924     SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  3.10
VALID DATA POINT #   5   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  75   MAX LIME INJECTION

486  13:30:29  101.0 16969  3358  2372  2049  2147  2292   894  2183  2655  2929 20879      3358   894  8860  7767      0.20  0.25  0.77  1.23       4.0  45.0  15.0  350.0 1000.0
                                                                                             157   548   548   479                                  0.0  55.6  18.5  432.4 1235.3
  0     0.0     94.7         650   646   624   622   638   532   640   623   635              77    30    90   171                                  3.0  47.6  15.9  370.6 1058.8
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  593 F   MILL OUT= 164 F   EXIT= 1552 F   EXIT(sp)= 1676 F   SMPL= 1298 F   SEC WB= 548 F   TER WB= 479 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  76   BASELINE STAGED

572  14:11:52  101.0 16963  3310  2465  2193  2217  2414   881  1999  2596  2798 20872      3310   881  9289  7393      0.20  0.25  0.79  1.23       4.0  45.0  15.0  370.0 1000.0
                                                                                             152   541   541   465                                  0.0  55.6  18.5  457.1 1235.3
  0     0.0     94.7         753   636   616   613   629   524   631   613   625              75    30    94   161                                  3.0  47.6  15.9  391.8 1058.8
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  679 F   MILL OUT= 157 F   EXIT= 1559 F   EXIT(sp)= 1673 F   SMPL= 1298 F   SEC WB= 541 F   TER WB= 465 F           SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  77   BASELINE STAGED
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DATE     :  02-29-84                                  TER DIA    :  8
SYSTEM   :  LWS                                       TER LOC    :  OUTER
BURNER   :  SSM-2                                     P.A.DES.   :  BL
FUEL     :  INDIANA4                                  OIL CHECK  :  S.88
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               LOAD       PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE   SEC   TER     PRIM  CORE  SEC  TOTAL     O2    CO    CO2    NO    SO2
PT#    TIME  MBTU/HR  TA                      FLOW SCFM                                        FLOW SCFM               SR (CUM)                        MEASURED
 OIL           CALC  SCFM                                                                      TEMP (F)                                                CORR TO 0% O2
(%)    LOAD    MEAS                           TEMP (F)                                    VELOCITY (FT/SEC)                                            CORR TO 3% O2
------------------------------------------------------------------------------------------------------------------------------------------------------
592  14:22:37  108.4 18213  3267  2557  2429  2336  2569   874  2823  2827  3023  21904     3267   874  9891  7872     0.18  0.23  0.77  1.20     3.6   50.0  15.6  350.0  880.0
                                                                                             153   542   542   470                               0.0   60.3  18.8  422.4 1062.1
                                                                                              74    29   100   172                               3.0   51.7  16.1  362.1  910.3
  0     0.0     94.7         755   632   613   610   626   526   629   611   622
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  691 F   MILL OUT= 158 F   EXIT= 1605 F   EXIT(sp)= 1717 F   SMPL= 1335 F   SEC WB= 542 F   TER WB= 470 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 273    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  0.63
VALID DATA POINT #  8   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  78   VICRON INJECTTION CURVE

672  15:02:43  101.5 17044  3357  2586  2290  2280  2459   877  1935  2700  2859  21342     3357   877  9615  7494     0.20  0.25  0.81  1.25     4.3   50.0  15.0  400.0  910.0
                                                                                             153   558   558   474                               0.0   62.9  18.9  503.0 1144.3
                                                                                              76    30    99   164                               3.0   53.9  16.2  431.1  980.8
  0     0.0     94.7         702   631   611   609   626   554   625   613   622
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  639 F   MILL OUT= 156 F   EXIT= 1582 F   EXIT(sp)= 1694 F   SMPL= 1315 F   SEC WB= 558 F   TER WB= 474 F              SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  9   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  79   BASELINE STAGED

688  15:11:51   94.6 15895  3222  2435  2044  2184  2362   892  1944  2623  2802  20508     3222   892  9025  7369     0.20  0.26  0.83  1.29     4.8   45.0  14.8  430.0  600.0
                                                                                             151   549   549   473                               0.0   58.3  19.2  557.4  777.8
                                                                                              73    30    92   161                               3.0   50.0  16.4  477.8  666.7
  0     0.0     94.7         746   635   613   612   629   538   629   615   625
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  687 F   MILL OUT= 156 F   EXIT= 1577 F   EXIT(sp)= 1679 F   SMPL= 1313 F   SEC WB= 549 F   TER WB= 473 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 817    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  2.16
VALID DATA POINT #  10   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  80   VICRON INJECTION CURVE

770  15:54:43   95.0 15956  3133  2469  2273  2222  2465   903  1807  2583  2733  20587     3133   903  9429  7123     0.20  0.25  0.84  1.29     4.8   40.0  14.2  405.0  960.0
                                                                                             150   539   539   462                               0.0   51.9  18.4  525.0 1244.4
                                                                                              71    30    95   154                               3.0   44.4  15.8  450.0 1066.7
  0     0.0     94.7         742   630   613   610   627   522   622   608   618
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  689 F   MILL OUT= 140 F   EXIT= 1538 F   EXIT(sp)= 1641 F   SMPL= 1288 F   SEC WB= 539 F   TER WB= 462 F              SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  81   BASELINE STAGED

801  16:09:17  100.7 16921  3129  2454  2220  2173  2430   887  1843  2888  3040  21064     3129   887  9278  7771     0.18  0.24  0.79  1.24     4.2   40.0  15.4  410.0  600.0
                                                                                             152   541   541   465                               0.0   50.0  19.3  512.5  750.0
                                                                                              71    30    94   169                               3.0   42.9  16.5  439.3  642.9
  0     0.0     94.7         716   634   612   610   629   529   626   612   622
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  659 F   MILL OUT= 158 F   EXIT= 1598 F   EXIT(sp)= 1685 F   SMPL= 1338 F   SEC WB= 541 F   TER WB= 465 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR=1046    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  2.60
VALID DATA POINT #  12   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  82   VICRON INJECTION CURVE

830  16:28:45  103.4 17368  3118  2521  2383  2279  2507   850  1746  3083  3261  21749     3118   850  9690  8090     0.18  0.23  0.79  1.25     4.3   40.0  15.0  385.0  880.0
                                                                                             154   587   587   502                               0.0   50.3  18.9  484.1 1106.6
                                                                                              71    30   103   183                               3.0   43.1  16.2  415.0  948.5
  0     0.0     94.7         669   674   653   650   668   577   663   654   663
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  617 F   MILL OUT= 161 F   EXIT= 1625 F   EXIT(sp)= 1607 F   SMPL= 1361 F   SEC WB= 587 F   TER WB= 502 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 485    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  1.17
VALID DATA POINT #  13   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  43   VICRON INJECTION CURVE

863  16:37:11  102.3 17178  3219  2568  2420  2281  2530   856  1770  3132  3266  22030     3219   856  9799  8162     0.19  0.24  0.81  1.28     4.7   40.0  15.0  450.0  540.0
                                                                                             152   582   582   499                               0.0   51.5  19.3  579.8  695.7
                                                                                              73    30   103   184                               3.0   44.2  16.6  496.9  596.3
  0     0.0     94.7         669   668   648   645   663   578   658   646   658
K-TRON=9000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 3.00IN H20    FURNACE P= 0.50IN H20    COAL P= 2.20IN H20
MILL IN=  614 F   MILL OUT= 159 F   EXIT= 1598 F   EXIT(sp)= 1577 F   SMPL= 1365 F   SEC WB= 582 F   TER WB= 499 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR=1500    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  3.67
VALID DATA POINT #  14   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  44   MAX. VICRON INJECTION
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DATE           :    02-29-84                          TER DIA      :    8
SYSTEM         :    LWS                               TER LOC      :    OUTER
BURNER         :    SSM-2                             P.A.DES.     :    BL
FUEL           :    INDIANA4                          OIL CHECK    :    5.88
-------------------------------------------------------------------------------------------------------------------------------------------
            LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE   SEC   TER      PRIM  CORE   SEC  TOTAL     O2    CO    CO2    NO    SO2
PT#   TIME  MBTU/HR  TA                           FLOW SCFM                                    FLOW SCFM                   SR (CUM)                      MEASURED
  OIL         CALC  SCFM                                                                        TEMP (F)                                               CORR TO 0% O2
(%)   LOAD    MEAS                               TEMP (F)                                  VELOCITY (FT/SEC)                                          CORR TO 3% O2
-------------------------------------------------------------------------------------------------------------------------------------------
                                                                                          3173   859  9876  7702      0.18  0.23  0.80  1.24      4.2  45.0  15.2  400.0  930.0
864 16:46:08  103.3 17359  3173  2592  2448  2287  2548   859  1665  2943  3094 21610      151   587   587   498                                  0.0  56.3  19.0  500.0 1162.5
                                                                                            72    30   105   173                                  3.0  48.2  16.3  428.6  996.4
  0   0.0     94.7          687   672   652   651   669   584   660   651   660
K-TRON=9000 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H2O    TER WINDBOX P= 3.00IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.20IN H2O
MILL IN=  637 F   MILL OUT= 154 F   EXIT= 1629 F   EXIT(sp)= 1599 F   SMPL= 1367 F   SEC WB= 587 F   TER WB= 498 F        SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  14   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  85   BASELINE STAGED
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DATE                 :      02-29-84                      TER  DIA          :      8
SYSTEM               :      LWS                           TER  LOC          :      OUTER
BURNER               :      SSM-2                         P.A.DES.          :      BL
FUEL                 :      UTAH8                         OIL  CHECK        :      5.88

            LOAD              PRIM   V -2   V -3   V -4   V -5   CORE   V -7   V -8   V -9   TOTAL          PRIM   CORE   SEC    TER          PRIM   CORE   SEC    TOTAL          O2    CO    CO2    NO     SO2
PT#    TIME  MBTU/HR  TA                                FLOW SCFM                                                   FLOW SCFM                          SR (CUM)                              MEASURED
  OIL         CALC   SCFM                                                                                          TEMP (F)                                                             CORR TO 0% O2
(%)    LOAD   MEAS                                       TEMP (F)                                              VELOCITY (FT/SEC)                                                        CORR TO 3% O2

988  17:42:19  101.1  16906   3423   2496   2176   2245   2405    863   2380   2707   2442  21135         3423    863   9321   7520        0.20   0.25   0.80   1.25          4.3   40.0  14.0  305.0  530.0
                                                                                                          153    588    588    506                                            0.0   50.3  18.6  383.5  666.5
  0    0.0    102.7           484    686    669    666    684    569    683    660    673                  78     30     99    171                                            3.0   43.1  16.0  328.7  571.3
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.50IN H2O     COAL P= 2.20IN H2O
MILL IN=  430 F   MILL OUT= 164 F   EXIT= 1553 F   EXIT(sp)= 1533 F   SMPL= 1315 F   SEC WB= 588 F   TER WB= 506 F            SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT # 15   ELAPSED TIME, MIN   6   RECORD ON TRK   0   FILE  45   BASELINE STAGED

---  17:51:13  102.0  17063   3393   2422   2105   2160   2368    856   2376   2810   2595  21085         3393    856   9055   7781        0.20   0.25   0.78   1.24          4.1   40.0  15.0  280.0  440.0
                                                                                                          153    589    589    508                                            0.0   49.7  18.6  347.9  546.7
  0    0.0    102.7           477    688    668    664    682    566    682    663    674                  77     30     96    177                                            3.0   42.6  16.0  298.2  468.6
K-TRON=9000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.50IN H2O     COAL P= 2.20IN H2O
MILL IN=  423 F   MILL OUT= 161 F   EXIT= 1572 F   EXIT(sp)= 1550 F   SMPL= 1333 F   SEC WB= 589 F   TER WB= 508 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 265     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  1.41
VALID DATA POINT # 16   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  87   VICRON INJECTION CURVE
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DATE        :   03-01-84                         TER DIA       :   8
SYSTEM      :   LWS                              TER LOC       :   OUTER
BURNER      :   SSM-2                            P.A.DES.      :   BL
FUEL        :   UTAH8                            OIL CHECK     :   4.86

                    LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL         PRIM  CORE   SEC   TER        PRIM  CORE   SEC  TOTAL          O2    CO    CO2    NO    SO2
PT#     TIME     MBTU/HR  TA                             FLOW SCFM                                          FLOW SCFM                         SR (CUM)                                 MEASURED
   OIL              CALC  SCFM                                                                              TEMP (F)                                                            CORR TO 0% O2
(%)     LOAD        MEAS                                 TEMP (F)                                        VELOCITY (FT/SEC)                                                      CORR TO 3% O2

220  10:48:55    99.6 16650  3423  3848  3963  3601  3763   870   241   443   542 20694          3423   870 15175  1226        0.21  0.26  1.17  1.24          4.2  40.0  14.6  685.0  520.0
                                                                                                  155   607   607   367                                        0.0  50.0  18.3  856.3  650.0
  0    0.0      94.7            485   694   678   676   686   563   615   603   631                  78    31   164    24                                        3.0  42.9  15.6  733.9  557.1
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 6.00IN H2O     TER WINDBOX P= 0.01IN H2O     FURNACE P= 0.40IN H2O     COAL P= 2.30IN H2O
MILL IN=  441 F   MILL OUT= 163 F   EXIT= 1556 F   EXIT(sp)= 1533 F   SMPL= 1304 F   SEC WB= 607 F   TER WB= 367 F            SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE   3   BASELINE UNSTAGED

326  11:43:57    99.4 16627  3383  2584  2095  2253  2359   870  2536  2587  2365 21033          3383   870  9291  7488        0.20  0.26  0.81  1.26          4.5  35.0  14.4  320.0  520.0
                                                                                                  155   565   565   479                                        0.0  44.5  18.3  407.3  661.8
  0    0.0      94.7            533   667   643   643   657   542   660   641   648                  77    30    96   165                                        3.0  38.2  15.7  349.1  567.3
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.15IN H2O     COAL P= 2.40IN H2O
MILL IN=  466 F   MILL OUT= 166 F   EXIT= 1527 F   EXIT(sp)= 1455 F   SMPL= 1270 F   SEC WB= 565 F   TER WB= 479 F            SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   9   RECORD ON TRK   1   FILE   4   BASELINE-STAGED

365  11:59:20   103.2 17258  3416  2518  2042  2206  2274   853  2685  2715  2493 21203          3416   853  9041  7894        0.20  0.25  0.77  1.23          4.0  40.0  14.8  275.0  300.0
                                                                                                  156   603   603   511                                        0.0  49.4  18.3  339.7  370.6
  0    0.0      94.7            476   701   675   674   688   586   691   673   675                  78    30    97   180                                        3.0  42.4  15.7  291.2  317.6
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.15IN H2O     COAL P= 2.40IN H2O
MILL IN=  424 F   MILL OUT= 167 F   EXIT= 1556 F   EXIT(sp)= 1479 F   SMPL= 1300 F   SEC WB= 603 F   TER WB= 511 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 245     SORBENT AIR FLOW=  248  SCFM   [Ca]/[S]=  1.73
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE   5   LIME INJECTION

404  12:17:26   100.2 16755  3337  2499  2190  2237  2322   870  2490  2502  2256 20703          3337   870  9248  7248        0.20  0.25  0.80  1.24          4.1  40.0  14.6  300.0  180.0
                                                                                                  156   593   593   502                                        0.0  49.7  18.1  372.8  223.7
  0    0.0      94.7            518   690   670   667   681   572   682   663   671                  76    31    99   164                                        3.0  42.6  15.6  319.5  191.7
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.15IN H2O     COAL P= 2.40IN H2O
MILL IN=  479 F   MILL OUT= 163 F   EXIT= 1567 F   EXIT(sp)= 1469 F   SMPL= 1307 F   SEC WB= 593 F   TER WB= 502 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 600     SORBENT AIR FLOW=  248  SCFM   [Ca]/[S]=  4.36
VALID DATA POINT #   4   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE   6   LIME INJECTION

445  12:39:55   102.8 17183  3349  2522  2292  2239  2328   839  2742  2702  2466 21481          3349   839  9382  7911        0.19  0.24  0.79  1.25          4.3  40.0  14.2  300.0  440.0
                                                                                                  157   597   597   508                                        0.0  50.3  17.9  377.2  553.3
  0    0.0      94.7            497   684   667   664   678   584   678   660   667                  76    30   100   180                                        3.0  43.1  15.3  323.4  474.3
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.15IN H2O     COAL P= 2.40IN H2O
MILL IN=  442 F   MILL OUT= 164 F   EXIT= 1561 F   EXIT(sp)= 1486 F   SMPL= 1310 F   SEC WB= 597 F   TER WB= 508 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR=  55     SORBENT AIR FLOW=  246  SCFM   [Ca]/[S]=  0.39
VALID DATA POINT #   5   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  46   LIME INJECTION

472  12:53:13   101.9 17045  3367  2493  2152  2235  2285   854  2613  2586  2358 20941          3367   854  9164  7556        0.20  0.25  0.79  1.23          4.0  40.0  14.8  290.0  500.0
                                                                                                  157   587   587   499                                        0.0  49.4  18.3  358.2  617.6
  0    0.0      94.7            533   682   665   662   676   565   677   657   664                  77    30    97   170                                        3.0  42.4  15.7  307.1  529.4
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.00IN H2O     TER WINDBOX P= 3.00IN H2O     FURNACE P= 0.15IN H2O     COAL P= 2.40IN H2O
MILL IN=  460 F   MILL OUT= 161 F   EXIT= 1565 F   EXIT(sp)= 1491 F   SMPL= 1311 F   SEC WB= 587 F   TER WB= 499 F            SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  89   BASELINE
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DATE        :   03-01-84                          TER DIA     :   8
SYSTEM      :   LWS                               TER LOC     :   INNER
BURNER      :   SSM-2                             P.A.DES.    :   BL
FUEL        :   UTAH8                             OIL CHECK   :   4.86

              LOAD     PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER     PRIM  CORE  SEC  TOTAL      O2   CO    CO2   NO    SO2
PT#   TIME  MBTU/HR TA                   FLOW SCFM                                            FLOW SCFM              SR (CUM)                         MEASURED
  OIL         CALC  SCFM                                                                      TEMP (F)                                              CORR TO 0% O2
(%)   LOAD    MEAS                       TEMP (F)                                         VELOCITY (FT/SEC)                                         CORR TO 3% O2

584 13:45:43  102.0 17061  3419  2716  2439  2166  2484   833  2529  2537  2584 21710.     3419   833  9807  7650     0.20  0.25  0.82  1.27      4.6  35.0  14.0  320.0  500.0
                                                                                            157   591   591   494                               0.0  44.8  17.9  409.8  640.2
  0    0.0    94.7          505   682   666   661   676   573   671   653   661             78    29   104   171                               3.0  38.4  15.4  351.2  548.8
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  440 F   MILL OUT= 163 F   EXIT= 1495 F   EXIT(sp)= 1474 F   SMPL= 1311 F   SEC WB= 591 F   TER WB= 494 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  90   BASLINE-STAGED-INNER

608 13:56:08  100.7 16830  3404  2700  2315  2122  2442   853  2508  2486  2460 21289      3404   853  9578  7455     0.20  0.25  0.82  1.26      4.5  35.0  14.2  340.0  210.0
                                                                                            157   582   582   487                               0.0  44.5  18.1  432.7  267.3
  0    0.0    94.7          460   684   666   659   675   546   676   649   663             78    30   101   166                               3.0  38.2  15.5  370.9  229.1
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  438 F   MILL OUT= 168 F   EXIT= 1507 F   EXIT(sp)= 1475 F   SMPL= 1321 F   SEC WB= 582 F   TER WB= 487 F   SORBENT= Ca(OH)2   TERT INJECTION   SORBENT LBS/HR= 397   SORBENT AIR FLOW=  241  SCFM   [Ca]/[S]=  2.87
VALID DATA POINT #   8   ELAPSED TIME, MIN   9   RECORD ON TRK   0   FILE  47   LIME INJECTION

661 14:23:26  100.6 16813  3421  2669  2309  2111  2387   860  2386  2374  2379 20897      3421   860  9477  7139     0.20  0.25  0.82  1.24      4.2  38.0  14.4  320.0  500.0
                                                                                            156   584   584   492                               0.0  47.5  18.0  400.0  625.0
  0    0.0    94.7          471   687   666   658   674   553   678   653   667             78    30   100   160                               3.0  40.7  15.4  342.9  535.7
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  458 F   MILL OUT= 160 F   EXIT= 1501 F   EXIT(sp)= 1482 F   SMPL= 1316 F   SEC WB= 584 F   TER WB= 492 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   9   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  92   BASELINE

698 14:38:39  101.7 17009  3455  2589  2289  2088  2358   853  2542  2543  2545 21263      3455   853  9325  7630     0.20  0.25  0.80  1.25      4.3  35.0  14.4  325.0  310.0
                                                                                            156   581   581   488                               0.0  44.0  18.1  408.7  389.8
  0    0.0    94.7          486   678   659   650   665   551   674   648   660             79    30    98   170                               3.0  37.7  15.5  350.3  334.1
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  435 F   MILL OUT= 160 F   EXIT= 1511 F   EXIT(sp)= 1489 F   SMPL= 1324 F   SEC WB= 581 F   TER WB= 488 F   SORBENT= Ca(OH)2   TERT INJECTION   SORBENT LBS/HR= 275   SORBENT AIR FLOW=  246  SCFM   [Ca]/[S]=  1.97
VALID DATA POINT #  10   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  48   LIME-INJECTION

729 14:54:54  104.7 17515  3430  2567  2277  2085  2359   852  2606  2609  2609 21395      3430   852  9288  7825     0.20  0.24  0.77  1.22      3.9  35.0  14.8  305.0  450.0
                                                                                            157   577   577   490                               0.0  43.0  18.2  374.6  552.6
  0    0.0    94.7          426   678   657   648   664   544   672   649   659             78    30    98   175                               3.0  36.8  15.6  321.1  473.7
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  409 F   MILL OUT= 167 F   EXIT= 1514 F   EXIT(sp)= 1493 F   SMPL= 1336 F   SEC WB= 577 F   TER WB= 490 F   SORBENT= Ca(OH)2   TERT INJECTION   SORBENT LBS/HR= 123   SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  0.85
VALID DATA POINT #  11   ELAPSED TIME, MIN   7   RECORD ON TRK   0   FILE  49   LIME INJECTION

766 15:12:46  103.5 17307  3521  2610  2448  2091  2450   841  2588  2619  2596 21763      3521   841  9599  7802     0.20  0.25  0.81  1.26      4.4  35.0  14.2  320.0  520.0
                                                                                            155   583   583   494                               0.0  44.3  18.0  404.8  657.8
  0    0.0    94.7          462   674   654   647   665   564   671   648   660             80    29   101   175                               3.0  38.0  15.4  347.0  563.9
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  395 F   MILL OUT= 165 F   EXIT= 1496 F   EXIT(sp)= 1482 F   SMPL= 1321 F   SEC WB= 583 F   TER WB= 494 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  95   BASELINE

813 15:35:29   99.4 16624  3452  2555  2159  1988  2313   861  2523  2527  2526 20904      3452   861  9016  7576     0.21  0.26  0.80  1.26      4.4  38.0  14.4  315.0  310.0
                                                                                            156   584   584   494                               0.0  48.1  18.2  398.5  392.2
  0    0.0    94.7          511   682   660   653   672   565   676   653   663             79    30    95   170                               3.0  41.2  15.6  341.6  336.1
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  450 F   MILL OUT= 158 F   EXIT= 1490 F   EXIT(sp)= 1459 F   SMPL= 1312 F   SEC WB= 584 F   TER WB= 494 F   SORBENT= VICRON    TERT INJECTION   SORBENT LBS/HR= 681   SORBENT AIR FLOW=  238  SCFM   [Ca]/[S]=  3.71
VALID DATA POINT #  13   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  96   LIMESTONE INJECTION
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DATE          :    03-01-84                       TER DIA      :   8
SYSTEM        :    LWS                            TER LOC      :   INNER
BURNER        :    SSM-2                          P.A.DES.     :   BL
FUEL          :    UTAH8                          OIL CHECK    :   4.86
---------------------------------------------------------------------------------------------------------------------------------------------------
                LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE  SEC   TER       PRIM  CORE  SEC  TOTAL        O2   CO    CO2   NO    SO2
PT#    TIME   MBTU/HR  TA                       FLOW SCFM                                            FLOW SCFM                     SR (CUM)                          MEASURED
  OIL           CALC  SCFM                                                                           TEMP (F)                                                         CORR TO 0% O2
(%)    LOAD     MEAS                            TEMP (F)                                          VELOCITY (FT/SEC)                                                   CORR TO 3% O2
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847  15:53:56   99.5 16642  3368  2536  2250  1947  2341   860  2551  2564  2511  20928        3368   860  9074  7625       0.20  0.25  0.80  1.26        4.4  35.0  14.2  320.0  390.0
                                                                                               155   585   585   497                                      0.0  44.3  18.0  404.8  493.4
  0    0.0      94.7          528   684   661   654   675   563   679   654   666                 77    30    96   172                                      3.0  38.0  15.4  347.0  422.9
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.40IN H20     TER WINDBOX P= 2.60IN H20     FURNACE P= 0.13IN H20     COAL P= 2.00IN H20
MILL IN=  466 F   MILL OUT= 159 F   EXIT= 1489 F   EXIT(sp)= 1473 F   SMPL= 1318 F   SEC WB= 585 F   TER WB= 497 F   SORBENT= VICRON     TERT INJECTION     SORBENT LBS/HR= 288     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  1.57
VALID DATA POINT #  14   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  97   LIMESTONE INJECTION

876  16:08:51   99.8 16693  3418  2519  2210  1946  2335   859  2549  2576  2458  20869        3418   859  9009  7583       0.20  0.26  0.80  1.25        4.3  35.0  13.8  320.0  440.0
                                                                                               156   579   579   493                                      0.0  44.0  17.4  402.4  553.3
  0    0.0      94.7          526   681   659   651   672   555   676   652   664                 78    30    95   170                                      3.0  37.7  14.9  344.9  474.3
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.40IN H20     TER WINDBOX P= 2.60IN H20     FURNACE P= 0.13IN H20     COAL P= 2.00IN H20
MILL IN=  465 F   MILL OUT= 169 F   EXIT= 1503 F   EXIT(sp)= 1480 F   SMPL= 1318 F   SEC WB= 579 F   TER WB= 493 F   SORBENT= VICRON     TERT INJECTION     SORBENT LBS/HR= 107     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  0.58
VALID DATA POINT #  15   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  98   LIMESTONE INJECTION

896  16:19:20  100.2 16754  3406  2537  2236  2001  2362   866  2484  2496  2434  20823        3406   866  9136  7414       0.20  0.26  0.80  1.24        4.2  35.0  14.2  310.0  520.0
                                                                                               156   582   582   489                                      0.0  43.0  17.0  387.5  650.0
  0    0.0      94.7          482   680   659   651   672   555   675   654   664                 78    30    96   165                                      3.0  37.5  15.2  332.1  557.1
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.40IN H20     TER WINDBOX P= 2.60IN H20     FURNACE P= 0.13IN H20     COAL P= 2.00IN H20
MILL IN=  442 F   MILL OUT= 160 F   EXIT= 1484 F   EXIT(sp)= 1471 F   SMPL= 1312 F   SEC WB= 582 F   TER WB= 489 F          SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  16   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  99   BASELINE
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DATE          :    03-01-84                      TER DIA       :    8
SYSTEM        :    LWS                           TER LOC       :    INNER
BURNER        :    SSM-2                         P.A.DES.      :    BL
FUEL          :    SAAR2                         OIL CHECK     :    4.86
-----------------------------------------------------------------------------------------------------------------------------------------------------
                 LOAD         PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER       PRIM  CORE   SEC  TOTAL        O2    CO   CO2    NO   SO2
PT#     TIME   MBTU/HR  TA                       FLOW SCFM                                            FLOW SCFM                      SR (CUM)                          MEASURED
  OIL            CALC  SCFM                                                                           TEMP (F)                                                       CORR TO 0% O2
(%)     LOAD     MEAS                             TEMP (F)                                        VELOCITY (FT/SEC)                                                  CORR TO 3% O2
-----------------------------------------------------------------------------------------------------------------------------------------------------

971  16:51:32  100.8 16995  3542  2594  2253  1974  2351   848  2489  2490  2465 21007          3542   848  9173  7444       0.21  0.26  0.80  1.24        4.1  50.0  15.0 300.0 560.0
                                                                                                 156   599   599   502                                    0.0  62.1  18.6 372.8 695.9
  0      0.0   100.7          392   684   662   656   675   601   675   656   665                  81    30    98   168                                    3.0  53.3  16.0 319.5 596.4
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  363 F   MILL OUT= 167 F   EXIT= 1512 F   EXIT(sp)= 1490 F   SMPL= 1317 F   SEC WB= 599 F   TER WB= 502 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  17   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE 100   BASELINE

999  17:07:59  100.3 16909  3389  2594  2267  1984  2347   851  2492  2494  2481 20900          3389   851  9193  7467       0.20  0.25  0.79  1.24        4.1  45.0  15.2 320.0 420.0
                                                                                                 156   599   599   503                                    0.0  55.9  18.9 397.6 521.9
  0      0.0   100.7          418   683   662   657   676   602   674   656   665                  77    30    99   169                                    3.0  47.9  16.2 340.8 447.3
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  387 F   MILL OUT= 162 F   EXIT= 1517 F   EXIT(sp)= 1496 F   SMPL= 1330 F   SEC WB= 599 F   TER WB= 503 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 355    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  2.06
VALID DATA POINT #  18   ELAPSED TIME, MIN   0   RECORD ON TRK   1   FILE 101   LIMESTONE INJECTION

---  17:19:59  101.3 17081  3415  2597  2277  1997  2352   849  2509  2510  2486 20992          3415   849  9222  7505       0.20  0.25  0.79  1.23        4.0  45.0  15.2 325.0 370.0
                                                                                                 156   596   596   499                                    0.0  55.6  18.8 401.5 457.1
  0      0.0   100.7          387   683   663   657   675   594   674   656   665                  78    30    99   169                                    3.0  47.6  16.1 344.1 391.8
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  368 F   MILL OUT= 163 F   EXIT= 1529 F   EXIT(sp)= 1509 F   SMPL= 1339 F   SEC WB= 596 F   TER WB= 499 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 494    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  2.84
VALID DATA POINT #  19   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE 102   LIMESTONE INJECTION

---  17:32:32  100.9 17019  3510  2605  2200  1986  2376   852  2513  2507  2468 21097          3510   852  9248  7488       0.21  0.26  0.80  1.24        4.2  45.0  15.0 320.0 460.0
                                                                                                 156   602   602   503                                    0.0  56.1  18.7 398.8 573.3
  0      0.0   100.7          441   682   664   658   675   603   674   656   665                  80    30   100   169                                    3.0  48.1  16.0 341.8 491.4
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  371 F   MILL OUT= 161 F   EXIT= 1516 F   EXIT(sp)= 1502 F   SMPL= 1328 F   SEC WB= 602 F   TER WB= 503 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 231    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  1.33
VALID DATA POINT #  20   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE 104   LIMESTONE INJECTION

---  17:58:33   99.1 16714  3441  2594  2264  1958  2349   849  2592  2580  2523 21150          3441   849  9165  7695       0.21  0.26  0.80  1.27        4.5  40.0  14.6 320.0 530.0
                                                                                                 157   604   604   507                                    0.0  50.9  18.6 407.3 674.5
  0      0.0   100.7          411   683   664   659   674   605   674   656   664                  79    30    99   175                                    3.0  43.6  15.9 349.1 578.2
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  367 F   MILL OUT= 162 F   EXIT= 1511 F   EXIT(sp)= 1501 F   SMPL= 1328 F   SEC WB= 604 F   TER WB= 507 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  21   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE 105   BASELINE

---  18:05:17   99.8 16822  3447  2567  2254  1967  2343   846  2612  2592  2534 21161          3447   846  9130  7739       0.20  0.26  0.80  1.26        4.4  40.0  14.6 330.0 340.0
                                                                                                 157   607   607   508                                    0.0  50.6  18.5 417.5 430.1
  0      0.0   100.7          422   686   667   662   676   610   677   659   667                  79    30    99   176                                    3.0  43.4  15.8 357.8 360.7
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  366 F   MILL OUT= 160 F   EXIT= 1529 F   EXIT(sp)= 1505 F   SMPL= 1343 F   SEC WB= 607 F   TER WB= 508 F   SORBENT= Ca(OH)2   TERT INJECTION    SORBENT LBS/HR= 399    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  3.12
VALID DATA POINT #  22   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE 106   LIME INJECTION

---  18:16:30  100.1 16882  3416  2563  2249  1980  2354   850  2580  2576  2536 21112          3416   850  9147  7700       0.20  0.25  0.79  1.25        4.3  38.0  14.6 330.0 430.0
                                                                                                 157   609   609   509                                    0.0  47.8  18.4 415.0 540.7
  0      0.0   100.7          371   686   668   663   676   614   677   659   668                  78    30    99   175                                    3.0  41.0  15.7 355.7 463.5
K-TRON=8300 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.40IN H20    TER WINDBOX P= 2.60IN H20    FURNACE P= 0.13IN H20    COAL P= 2.00IN H20
MILL IN=  379 F   MILL OUT= 161 F   EXIT= 1532 F   EXIT(sp)= 1512 F   SMPL= 1346 F   SEC WB= 609 F   TER WB= 509 F   SORBENT= Ca(OH)2   TERT INJECTION    SORBENT LBS/HR= 120    SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  0.94
VALID DATA POINT #  23   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE 110   LIME INJECTION
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DATE          :    03-01-84                              TER DIA      :    8
SYSTEM        :    LWS                                   TER LOC      :    INNER
BURNER        :    SSM-2                                 P.A.DES.     :    BL
FUEL          :    SAAR2                                 OIL CHECK    :    4.86
--------------------------------------------------------------------------------------------------------------------------------------------
                LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER      PRIM  CORE  SEC   TOTAL      O2   CO    CO2   NO    SO2
PT#     TIME  MBTU/HR  TA                          FLOW SCFM                                        FLOW SCFM                  SR (CUM)                        MEASURED
  OIL           CALC  SCFM                                                                           TEMP (F)                                                CORR TO 0% O2
(%)     LOAD    MEAS                               TEMP (F)                                      VELOCITY (FT/SEC)                                          CORR TO 3% O2
--------------------------------------------------------------------------------------------------------------------------------------------

--- 10:20:17    99.0 16697  3430  2560  2262  1982  2343   845  2594  2560  2520 21120      3430   845  9156  7690      0.21  0.26  0.80  1.27      4.5  40.0  14.4  340.0  390.0
                                                                                             157   610   610   510                                   0.0  50.9  18.3  432.7  496.4
  0     0.0     108.7          401   683   666   662   674   613   675   658   665            79    30    99   175                                   3.0  43.6  15.7  370.9  425.5
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=  0.0 %     SEC WINDBOX P= 2.40IN H2O     TER WINDBOX P= 2.60IN H2O     FURNACE P= 0.13IN H2O     COAL P= 2.00IN H2O
MILL IN=  360 F   MILL OUT= 160 F   EXIT= 1520 F   EXIT(sp)= 1506 F   SMPL= 1330 F   SEC WB= 610 F   TER WB= 510 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 100     SORBENT AIR FLOW=  247  SCFM   [Ca]/[S]=  1.42
VALID DATA POINT #  24   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE 107   LIME INJECTION

--- 10:30:57    99.9 16837  3495  2581  2257  1929  2357   849  2602  2588  2522 21180      3495   849  9124  7712      0.21  0.26  0.80  1.26      4.4  40.0  14.6  330.0  540.0
                                                                                             158   610   610   509                                   0.0  50.6  10.5  417.5  683.1
  0     0.0     100.7          403   682   666   662   674   612   674   657   665            80    30    99   176                                   3.0  43.4  15.0  357.8  585.5
K-TRON=8300 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=  0.0 %     SEC WINDBOX P= 2.40IN H2O     TER WINDBOX P= 2.60IN H2O     FURNACE P= 0.13IN H2O     COAL P= 2.00IN H2O
MILL IN=  345 F   MILL OUT= 163 F   EXIT= 1533 F   EXIT(sp)= 1510 F   SMPL= 1342 F   SEC WB= 610 F   TER WB= 509 F            SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  25   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE 109   BASELINE
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DATE       :   03-02-84                                  TER DIA     :   1.0
SYSTEM     :   LWS                                       TER LOC     :   INNER
BURNER     :   SSM-2                                     P.A.DES.    :   BL
FUEL       :   SAAR2                                     OIL CHECK   :   3.02

              LOAD          PRIN  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE   SEC   TER       PRIM  CORE   SEC  TOTAL       O2    CO   CO2    NO   SO2
PT#    TIME  MBTU/HR  TA                           FLOW SCFM                                      FLOW SCFM                     SR (CUM)                              MEASURED
  OIL          CALC  SCFM                                                                          TEMP (F)                                                        CORR TO 0% O2
(%)    LOAD    MEAS                                TEMP (F)                                    VELOCITY (FT/SEC)                                                  CORR TO 3% O2

149  09:53:48  100.3 16918  3391  3997  4461  3515  3778   851   282   301   500 21156      3391   851 15751  1164       0.20  0.25  1.18  1.25       4.3  55.0  15.0 520.0   0.0
                                                                                             160   616   616   376                                    0.0  69.2  18.9 653.9   0.0
 85   62.9   103.5           436   678   662   658   667   600   600   567   616              78    31   172    14                                    3.0  59.3  16.2 560.5   0.0
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0,0 %    SEC WINDBOX P= 6.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  415 F   MILL OUT= 163 F   EXIT= 1575 F   EXIT(sp)= 1698 F   SMPL= 1310 F   SEC WB= 616 F   TER WB= 376 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   1   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE 111   BASELINE UNSTAGED

186  10:09:34  101.4 17095  3351  2733  2300  2052  2443   851  2173  2788  2563 21254      3351   851  9528  7524       0.20  0.25  0.80  1.24       4.2  50.0  15.4 350.0 560.0
                                                                                             159   599   599   479                                    0.0  62.5  19.3 437.5 700.0
 85   62.9   103.5           433   670   662   658   668   591   661   647   653              77    30   102   105                                    3.0  53.6  16.5 375.0 600.0
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.00IN H20    TER WINDBOX P= 2.00IN H20    FURNACE P= 0.25IN H20    COAL P= 2.40IN H20
MILL IN=  406 F   MILL OUT= 163 F   EXIT= 1540 F   EXIT(sp)= 1674 F . SMPL= 1296 F   SEC WB= 599 F   TER WB= 479 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE 112   BASELINE-STAGED

240  10:38:20  101.3 17088  3239  2607  2275  1995  2351   848  2248  3007  2800 21369      3239   848  9227  8055       0.19  0.24  0.78  1.25       4.3  45.0  15.0 380.0 350.0
                                                                                             156   593   593   499                                    0.0  56.6  18.9 477.0 440.1
 85   62.9   103.5           423   689   672   667   682   570   679   666   672              74    30    98   114                                    3.0  48.5  16.2 409.6 377.2
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.20IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  387 F   MILL OUT= 163 F   EXIT= 1586 F   EXIT(sp)= 1720 F   SMPL= 1340 F   SEC WB= 593 F   TER WB= 499 F   SORBENT= VICRON   MILL INJECTION   SORBENT LBS/HR= 609   SORBENT AIR FLOW=  249  SCFM   [Ca]/[S]=  3.50
VALID DATA POINT #   3   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE 113   VICRON INJECTION CURVE

265  10:40:30  101.7 17151  3248  2623  2276  1992  2364   854  2260  3022  2808 21447      3248   854  9255  8091       0.19  0.24  0.78  1.25       4.3  45.0  15.0 380.0 400.0
                                                                                             155   587   587   494                                    0.0  56.6  18.9 477.8 503.0
 85   62.9   103.5           441   686   670   664   680   558   676   664   671              74    30    98   114                                    3.0  48.5  16.2 409.6 431.1
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.20IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  385 F   MILL OUT= 166 F   EXIT= 1595 F   EXIT(sp)= 1731 F   SMPL= 1340 F   SEC WB= 587 F   TER WB= 494 F   SORBENT= VICRON   MILL INJECTION   SORBENT LBS/HR= 344   SORBENT AIR FLOW=  250  SCFM   [Ca]/[S]=  1.97
VALID DATA POINT #   4   ELAPSED TIME, MIN   9   RECORD ON TRK   1   FILE 114   VICRON INJECTION CURVE

296  11:07:18  101.7 17143  3257  2657  2276  2014  2387   861  2057  2826  2612 20948      3257   861  9334  7495       0.19  0.24  0.78  1.22       3.9  45.0  15.4 360.0 460.0
                                                                                             155   586   586   486                                    0.0  55.3  18.9 442.1 564.9
 85   62.9   103.5           419   686   667   662   677   559   673   660   668              74    30    99   105                                    3.0  47.4  16.2 378.9 484.2
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.20IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  380 F   MILL OUT= 162 F   EXIT= 1596 F   EXIT(sp)= 1723 F   SMPL= 1337 F   SEC WB= 586 F   TER WB= 486 F   SORBENT= VICRON   MILL INJECTION   SORBENT LBS/HR= 172   SORBENT AIR FLOW=  249  SCFM   [Ca]/[S]=  0.98
VALID DATA POINT #   5   ELAPSED TIME, MIN   9   RECORD ON TRK   1   FILE 115   VICRON INJECTION CURVE

323  11:21:45  101.1 17042  3257  2673  2383  1999  2421   849  2248  3044  2819 21693      3257   849  9475  8112       0.19  0.24  0.80  1.27       4.6  45.0  14.6 370.0 500.0
                                                                                             155   584   584   486                                    0.0  57.6  18.7 473.8 640.2
 85   62.9   103.5           458   679   664   658   674   547   672   657   664              74    30   100   114                                    3.0  49.4  16.0 406.1 548.8
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 2.20IN H20    TER WINDBOX P= 2.80IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  395 F   MILL OUT= 159 F   EXIT= 1579 F   EXIT(sp)= 1620 F   SMPL= 1332 F   SEC WB= 584 F   TER WB= 486 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=   0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   6   ELAPSED TIME, MIN  10   RECORD ON TRK   1   FILE 116   BASELINE STAGED
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DATE          :   03-02-84                     TER DIA      :   1.0
SYSTEM        :   LWS                          TER LOC      :   INNER
BURNER        :   SSM-2                        P.A.DES.     :   BL
FUEL          :   UTAH8                        OIL CHECK    :   3.02
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              LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL     PRIM  CORE  SEC   TER      PRIM  CORE  SEC  TOTAL      O2    CO    CO2   NO    SO2
PT#    TIME   MBTU/HR  TA                      FLOW SCFM                                         FLOW SCFM                  SR (CUM)                         MEASURED
  OIL         CALC   SCFM                                                                        TEMP (F)                                           CORR TO 0% O2
(%)    LOAD   MEAS                             TEMP (F)                                     VELOCITY (FT/SEC)                                       CORR TO 3% O2
------------------------------------------------------------------------------------------------------------------------------------------------------

366  11:39:41   100.7 16846  3396  2646  2248  2019  2347   854  2137  2898  2638 21183    3396   854  9260  7673     0.20  0.25  0.80  1.26      4.4  40.0  14.0 345.0 500.0
                                                                                            154   584   584   484                              0.0  50.6  17.7 436.4 632.5
                                                                                             77    30    98   107                              3.0  43.4  15.2 374.1 542.2
  0    0.0    90.1          483   678   661   655   672   559   669   653   662
K-TRON=7900 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  432 F   MILL OUT= 160 F   EXIT= 1568 F   EXIT(sp)= 1152 F   SMPL= 1328 F   SEC WB= 584 F   TER WB= 484 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   7   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  10   BASELINE STAGED

387  11:53:19    98.2 16427  3387  2660  2242  1968  2327   852  2115  2749  2479 20779    3387   852  9197  7343     0.21  0.26  0.82  1.26      4.5  38.0  14.0 370.0 300.0
                                                                                            155   506   586   479                              0.0  48.4  17.8 470.9 381.8
                                                                                             77    30    97   102                              3.0  41.5  15.3 403.6 327.3
  0    0.0    91.3          409   666   651   647   661   570   657   643   651
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  447 F   MILL OUT= 161 F   EXIT= 1574 F   EXIT(sp)= 1131 F   SMPL= 1337 F   SEC WB= 586 F   TER WB= 479 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 609    SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  3.36
VALID DATA POINT #   8   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  11   VICRON INJECTION CURVE

419  12:09:59    99.8 16693  3393  2643  2221  1994  2316   857  2136  2861  2570 20991    3393   857  9174  7567     0.20  0.25  0.80  1.26      4.4  35.0  13.8 350.0 340.0
                                                                                            155   580   580   470                              0.0  44.3  17.5 442.8 430.1
                                                                                             77    30    97   105                              3.0  38.0  15.0 379.5 368.7
  0    0.0    91.3          482   669   652   648   664   566   658   645   652
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  438 F   MILL OUT= 160 F   EXIT= 1542 F   EXIT(sp)= 1107 F   SMPL= 1334 F   SEC WB= 580 F   TER WB= 470 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 408    SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  2.22
VALID DATA POINT #   9   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  12   VICRON INJECTION CURVE

440  12:26:12    99.1 16565  3347  2615  2211  1981  2313   852  2105  2056  2552 20830    3347   852  9120  7512     0.20  0.25  0.80  1.26      4.4  35.0  13.6 350.0 400.0
                                                                                            155   592   592   480                              0.0  44.3  17.2 442.8 506.0
                                                                                             76    30    97   105                              3.0  38.0  14.7 379.5 433.7
  0    0.0    91.3          482   687   667   663   679   574   675   659   667
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  432 F   MILL OUT= 164 F   EXIT= 1547 F   EXIT(sp)= 1520 F   SMPL= 1335 F   SEC WB= 592 F   TER WB= 480 F   SORBENT= VICRON    MILL INJECTION    SORBENT LBS/HR= 203    SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  1.11
VALID DATA POINT #  10   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  13   VICRON INJECTION CURVE

477  12:39:36   101.8 17026  3575  2633  2209  1980  2296   849  2102  2828  2566 21039    3575   849  9118  7496     0.21  0.26  0.80  1.24      4.1  35.0  14.0 330.0 480.0
                                                                                            156   592   592   484                              0.0  43.5  17.4 410.1 596.4
                                                                                             82    30    97   105                              3.0  37.3  14.9 351.5 511.2
  0    0.0    91.3          437   676   659   654   670   577   666   649   660
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  401 F   MILL OUT= 168 F   EXIT= 1557 F   EXIT(sp)= 1513 F   SMPL= 1343 F   SEC WB= 592 F   TER WB= 484 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  11   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  14   BASELINE STAGED

502  12:52:18   101.2 16927  3465  2623  2216  1976  2314   849  2195  2903  2619 21161    3465   849  9129  7717     0.20  0.25  0.79  1.25      4.3  35.0  13.8 340.0 510.0
                                                                                            156   584   584   486                              0.0  44.0  17.4 427.5 641.3
                                                                                             79    30    97   108                              3.0  37.7  14.9 366.5 549.1
  0    0.0    91.3          472   676   658   653   669   568   665   652   658
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  423 F   MILL OUT= 162 F   EXIT= 1546 F   EXIT(sp)= 1520 F   SMPL= 1344 F   SEC WB= 584 F   TER WB= 486 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  12   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  15   BASELINE STAGED

542  13:11:20    99.3 16590  3487  2601  2300  1900  2339   836  2155  2991  2638 21248    3487   836  9141  7785     0.21  0.26  0.81  1.28      4.7  35.0  13.4 375.0 300.0
                                                                                            158   600   600   494                              0.0  45.1  17.3 483.1 386.5
                                                                                             80    30    98   110                              3.0  38.7  14.8 414.1 331.5
  0    0.0    91.3          443   683   664   659   676   595   673   660   665
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H2O    TER WINDBOX P= 2.40IN H2O    FURNACE P= 0.50IN H2O    COAL P= 2.30IN H2O
MILL IN=  407 F   MILL OUT= 161 F   EXIT= 1549 F   EXIT(sp)= 1513 F   SMPL= 1355 F   SEC WB= 600 F   TER WB= 494 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 572    SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  3.13
VALID DATA POINT #  13   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  16   VICRON INJECTION CURVE
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DATE           :   03-02-84                          TER DIA      :   1.0
SYSTEM         :   LWS                               TER LOC      :   INNER
BURNER         :   SSM-2                             P.A.DES.     :   BL
FUEL           :   UTAH8                             OIL CHECK    :   3.02

                LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE  SEC   TER        PRIM  CORE  SEC   TOTAL        O2    CO    CO2   NO     SO2
PT#    TIME    MBTU/HR  TA                      FLOW SCFM                                           FLOW SCFM                      SR (CUM)                              MEASURED
  OIL           CALC   SCFM                                                                          TEMP (F)                                                          CORR TO 0% O2
(%)    LOAD     MEAS                            TEMP (F)                                         VELOCITY (FT/SEC)                                                     CORR TO 3% O2

649  14:04:08   101.4 16954  3426  2621  2310  1953  2325   752  2360  3033  2538 21320        3426   752  9210  7932       0.20  0.25  0.79  1.26         4.4  35.0  14.4 375.0 380.0
                                                                                                156   587   587   481                                     0.0  44.3  18.2 474.4 460.7
  0     0.0      91.3          474   674   655   649   707   810   666   640   656                78    26    98   111                                     3.0  38.0  15.6 406.6 412.0
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  413 F   MILL OUT= 164 F   EXIT= 1536 F   EXIT(sp)= 1523 F   SMPL= 1370 F   SEC WB= 587 F   TER WB= 481 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 370     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  1.98
VALID DATA POINT #  14   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  17   LIMESTONE INJECTION

677  14:16:55   102.1 17067  3408  2633  2354  1982  2423   849  2415  3082  2572 21717        3408   849  9391  8069       0.20  0.25  0.80  1.27         4.6  35.0  14.0 380.0 440.0
                                                                                                156   564   564   467                                     0.0  44.8  17.9 486.6 563.4
  0     0.0      91.3          489   650   635   628   644   533   630   619   635                78    29    97   111                                     3.0  38.4  15.4 417.1 482.9
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  411 F   MILL OUT= 160 F   EXIT= 1523 F   EXIT(sp)= 1522 F   SMPL= 1362 F   SEC WB= 564 F   TER WB= 467 F   SORBENT= VICRON    TERT INJECTION    SORBENT LBS/HR= 120     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  0.64
VALID DATA POINT #  15   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  18   VICRON INJECTION CURVE

701  14:30:58   101.2 16923  3404  2696  2231  1921  2376   866  2295  2938  2428 21156        3404   866  9224  7662       0.20  0.25  0.80  1.25         4.3  38.0  14.2 340.0 540.0
                                                                                                156   541   541   449                                     0.0  47.8  17.9 427.5 679.0
  0     0.0      91.3          472   624   609   604   619   516   622   602   612                78    29    94   103                                     3.0  41.0  15.3 366.5 582.0
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  416 F   MILL OUT= 164 F   EXIT= 1548 F   EXIT(sp)= 1513 F   SMPL= 1361 F   SEC WB= 541 F   TER WB= 449 F              SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  16   ELAPSED TIME, MIN   7   RECORD ON TRK   1   FILE  19   BASELINE

817  15:22:32   101.5 16974  3403  2707  2382  1932  2484   876  2241  2939  2382 21345        3403   876  9505  7561       0.20  0.25  0.81  1.26         4.4  40.0  13.6 370.0 230.0
                                                                                                155   510   510   425                                     0.0  50.6  17.2 468.1 291.0
  0     0.0      91.3          483   593   569   563   582   492   586   571   575                77    28    93    99                                     3.0  43.4  14.7 401.2 249.4
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  445 F   MILL OUT= 160 F   EXIT= 1543 F   EXIT(sp)= 1514 F   SMPL= 1372 F   SEC WB= 510 F   TER WB= 425 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 480     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  3.44
VALID DATA POINT #  17   ELAPSED TIME, MIN   8   RECORD ON TRK   1   FILE  20   LIME INJECTION CURVE

863  15:49:58    99.1 16562  3359  2626  2222  1891  2414   870  2237  2950  2381 20950        3359   870  9153  7568       0.20  0.26  0.81  1.26         4.5  35.0  13.4 355.0 500.0
                                                                                                155   531   531   443                                     0.0  44.5  17.1 451.0 636.4
  0     0.0      91.3          466   614   591   586   605   518   607   594   596                76    29    92   101                                     3.0  38.2  14.6 387.3 545.5
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  433 F   MILL OUT= 159 F   EXIT= 1532 F   EXIT(sp)= 1497 F   SMPL= 1361 F   SEC WB= 531 F   TER WB= 443 F              SORBENT LBS/HR=   0     SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #  18   ELAPSED TIME, MIN   4   RECORD ON TRK   1   FILE  21   BASELINE STAGED

877  15:55:08    99.5 16636  3340  2638  2190  1900  2408   870  2255  2960  2350 20919        3340   870  9144  7565       0.20  0.25  0.80  1.26         4.4  35.0  13.6 365.0 340.0
                                                                                                155   536   536   445                                     0.0  44.3  17.2 461.7 430.1
  0     0.0      91.3          520   627   603   597   618   510   622   604   610                76    29    92   101                                     3.0  38.0  14.7 395.8 368.7
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  466 F   MILL OUT= 160 F   EXIT= 1547 F   EXIT(sp)= 1500 F   SMPL= 1368 F   SEC WB= 536 F   TER WB= 445 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 152     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  1.11
VALID DATA POINT #  19   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE  22   LIME INJECTION CURVE

897  16:09:32   100.4 16792  3390  2627  2168  1906  2404   870  2246  2910  2349 20870        3390   870  9106  7505       0.20  0.25  0.80  1.24         4.2  35.0  13.6 355.0 320.0
                                                                                                155   553   553   457                                     0.0  43.0  17.0 443.0 400.0
  0     0.0      91.3          490   650   624   618   642   524   644   624   632                77    29    93   102                                     3.0  37.5  14.6 380.4 342.9
K-TRON=8000 LBS/HR     CORE=  45 DEG     SEC SWIRL SETTING= 2.40   CM     SPREADER BLOCKAGE=   0.0 %     SEC WINDBOX P= 2.20IN H20     TER WINDBOX P= 2.40IN H20     FURNACE P= 0.50IN H20     COAL P= 2.30IN H20
MILL IN=  443 F   MILL OUT= 172 F   EXIT= 1549 F   EXIT(sp)= 1501 F   SMPL= 1373 F   SEC WB= 553 F   TER WB= 457 F   SORBENT= Ca(OH)2    TERT INJECTION    SORBENT LBS/HR= 220     SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  1.59
VALID DATA POINT #  20   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE  23   LINE INJECTION CURVE
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DATE          :   03-02-84                                         TER DIA      :   1.0
SYSTEM        :   LWS                                              TER LOC      :   INNER
BURNER        :   SSM-2                                            P.A.DES.     :   BL
FUEL          :   UTAH8                                            OIL CHECK    :   3.02

              LOAD          PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL        PRIM  CORE   SEC   TER       PRIM  CORE   SEC  TOTAL        O2    CO    CO2    NO    SO2
PT#     TIME  MBTU/HR  TA                         FLOW SCFM                                            FLOW SCFM                     SR (CUM)                          MEASURED
  OIL          CALC  SCFM                                                                               TEMP (F)                                                     CORR TO 0% O2
(%)   LOAD     MEAS                               TEMP (F)                                         VELOCITY (FT/SEC)                                                CORR TO 3% O2

  6 16:28:41    98.9 16535  3434  2562  2162  1838  2373   859  2206  2903  2335 20671         3434   859  8934  7443       0.21  0.26  0.80  1.25        4.3  35.0  13.4  365.0  430.0
                                                                                                   32    32    32    32                                       0.0  44.0  16.9  459.0  540.7
  0     0.0     91.3         425   667   641   634   657   568   658   644   649                   63    14    45    54                                       3.0  37.7  14.4  393.4  463.5
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H20    TER WINDBOX P= 2.30IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=   32 F   MILL OUT=  32 F   EXIT=   32 F   EXIT(sp)=   32 F   SMPL=  32 F   SEC WB=  32 F   TER WB=  32 F   SORBENT= Ca(OH)2   TERT INJECTION   SORBENT LBS/HR=  93   SORBENT AIR FLOW=  245  SCFM   [Ca]/[S]=  0.68
VALID DATA POINT #   1   ELAPSED TIME, MIN   8   RECORD ON TRK   0   FILE  50   LIME INJECTION CURVE

 17 16:34:31   103.5 17302  3471  2589  2262  1892  2371   849  2294  3167  2610 21504         3471   849  9113  8071       0.20  0.25  0.78  1.24        4.2  35.0  13.6  350.0  500.0
                                                                                                  156   574   574   478                                       0.0  43.8  17.0  437.5  625.0
  0     0.0     91.3         445   667   642   636   659   548   659   647   651                   79    29    95   112                                       3.0  37.5  14.6  375.0  535.7
K-TRON=8000 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 2.20IN H20    TER WINDBOX P= 2.30IN H20    FURNACE P= 0.50IN H20    COAL P= 2.30IN H20
MILL IN=  386 F   MILL OUT= 167 F   EXIT= 1539 F   EXIT(sp)= 1527 F   SMPL= 1378 F   SEC WB= 574 F   TER WB= 478 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   2   ELAPSED TIME, MIN   4   RECORD ON TRK   1   FILE 132   BASELINE STAGED

125 17:25:45    53.3  8906  3179  1881  1994  1483  1734   472   132   175   217 11266         3179   472  7091   524       0.36  0.41  1.21  1.26        4.5  45.0  13.6  300.0  490.0
                                                                                                  154   606   606   319                                       0.0  57.3  17.3  381.8  623.6
  0     0.0     51.3         423   726   689   676   701   573   607   561   627                   72    17    77     6                                       3.0  49.1  14.8  327.3  534.5
K-TRON=4500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.04IN H20    COAL P= 1.50IN H20
MILL IN=  371 F   MILL OUT= 161 F   EXIT= 1351 F   EXIT(sp)= 1203 F   SMPL= 1065 F   SEC WB= 606 F   TER WB= 319 F            SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   3   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE 133   BASELINE UNSTAGED-50% LOAD

137 17:34:22    53.9  9018  3192  1899  1834  1403  1763   472    94   184   224 11144         3192   472  6978   502       0.35  0.41  1.18  1.24        4.1  45.0  14.0  300.0  140.0
                                                                                                  153   602   602   309                                       0.0  55.9  17.4  372.8  174.0
  0     0.0     51.3         421   722   683   671   695   577   604   553   624                   72    17    75     6                                       3.0  47.9  14.9  319.5  149.1
K-TRON=4500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.04IN H20    COAL P= 1.50IN H20
MILL IN=  364 F   MILL OUT= 162 F   EXIT= 1346 F   EXIT(sp)= 1185 F   SMPL= 1068 F   SEC WB= 602 F   TER WB= 309 F   SORBENT= VICRON   TERT INJECTION   SORBENT LBS/HR= 437   SORBENT AIR FLOW=  202  SCFM   [Ca]/[S]=  4.39
VALID DATA POINT #   4   ELAPSED TIME, MIN   5   RECORD ON TRK   0   FILE  51   VICRON INJECTTION-UNSTAGED

153 17:45:59    53.3  8917  3210  1888  1867  1407  1777   472   121   183   223 11148         3210   472  6939   527       0.36  0.41  1.19  1.25        4.3  45.0  14.0  290.0  370.0
                                                                                                  153   621   621   311                                       0.0  56.6  17.6  364.7  465.3
  0     0.0     51.3         434   740   698   685   713   589   608   565   634                   73    17    76     6                                       3.0  48.5  15.1  312.6  398.8
K-TRON=4500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.04IN H20    COAL P= 1.50IN H20
MILL IN=  363 F   MILL OUT= 161 F   EXIT= 1345 F   EXIT(sp)= 1175 F   SMPL= 1063 F   SEC WB= 621 F   TER WB= 311 F   SORBENT= VICRON   TERT INJECTION   SORBENT LBS/HR= 168   SORBENT AIR FLOW=  202  SCFM   [Ca]/[S]=  1.71
VALID DATA POINT #   5   ELAPSED TIME, MIN   6   RECORD ON TRK   1   FILE 135   VICRON INJECTION CURVE

168 17:55:01    53.5  8942  3162  1836  1819  1440  1713   475   129   187   225 10986         3162   475  6808   541       0.35  0.41  1.17  1.23        4.0  50.0  14.2  290.0  480.0
                                                                                                  154   688   688   324                                       0.0  61.8  17.5  358.2  592.9
  0     0.0     51.3         371   830   769   757   792   643   658   605   684                   72    18    79     6                                       3.0  52.9  15.0  307.1  508.2
K-TRON=4500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.04IN H20    COAL P= 1.50IN H20
MILL IN=  365 F   MILL OUT= 160 F   EXIT= 1320 F   EXIT(sp)= 1171 F   SMPL= 1056 F   SEC WB= 688 F   TER WB= 324 F   SORBENT= VICRON   TERT INJECTION   SORBENT LBS/HR=  50   SORBENT AIR FLOW=  202  SCFM   [Ca]/[S]=  0.51
VALID DATA POINT #   6   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE   0   VICRON INJECTION CURVE

183 18:06:14    54.9  9174  3001  1843  2106  1609  1804   437   116   168   187 11271         3001   437  7362   471       0.33  0.37  1.18  1.23        4.0  45.0  14.6  320.0  420.0
                                                                                                  153   755   755   346                                       0.0  55.6  18.0  395.3  518.8
  0     0.0     51.3         386   908   851   833   865   689   699   642   734                   68    18    91     6                                       3.0  47.6  15.5  338.8  444.7
K-TRON=4500 LBS/HR    CORE=  45 DEG    SEC SWIRL SETTING= 2.40   CM    SPREADER BLOCKAGE=   0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.04IN H20    COAL P= 1.50IN H20
MILL IN=  366 F   MILL OUT= 160 F   EXIT= 1349 F   EXIT(sp)= 1188 F   SMPL= 1075 F   SEC WB= 755 F   TER WB= 346 F   SORBENT= VICRON   MILL INJECTION   SORBENT LBS/HR=  90   SORBENT AIR FLOW=  202  SCFM   [Ca]/[S]=  0.89
VALID DATA POINT #   7   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE   1   VICRON IN MILL
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DATE                    :   03-02-84                          TER DIA       :   1.0
SYSTEM                  :   LWS                               TER LOC       :   INNER
BURNER                  :   SSM-2                             P.A.DES.      :   BL
FUEL                    :   UTAH8                             OIL CHECK     :   3.02
------------------------------------------------------------------------------------------------------------------------------------
              LOAD        PRIM  V -2  V -3  V -4  V -5  CORE  V -7  V -8  V -9  TOTAL      PRIM  CORE  SEC   TER     PRIM  CORE  SEC   TOTAL     02    CO    CO2   NO    SO2
PT#   TIME    MBTU/HR TA                         FLOW SCFM                                     FLOW SCFM                   SR (CUM)                             MEASURED
  OIL          CALC   SCFM                                                                      TEMP (F)                                                   CORR TO 0% 02
(%)   LOAD     MEAS                              TEMP (F)                                  VELOCITY (FT/SEC)                                               CORR TO 3% 02
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193  10:15:14  54.3   9070  2984  1049  2096  1569  1766  427   102   174   105  11153      2984  427   7281  461     0.33  0.38  1.18  1.23      4.0   45.0  14.2  320.0  500.0
                                                .                                          153   782   782   356                                  0.0   55.6  17.5  395.3  617.6
  0    0.0     51.3         379   946   895   872   902   706   730   670   758             68    18    92     6                                  3.0   47.6  15.0  338.8  529.4
K-1RUN=4500 LBS/HR    CORE= 45 DEG    SEC SWIRL SETTING= 2.40  CM    SPREADER BLOCKAGE=  0.0 %    SEC WINDBOX P= 1.00IN H20    TER WINDBOX P= 0.01IN H20    FURNACE P= 0.04IN H20    COAL P= 1.50IN H20
MILL IN=  383 F   MILL OUT= 160 F   EXIT= 1325 F   EXIT(sp)= 1187 F   SMPL= 1064 F   SEC WB= 782 F   TER WB= 356 F          SORBENT LBS/HR=   0    SORBENT AIR FLOW=    0  SCFM   [Ca]/[S]=  0.00
VALID DATA POINT #   8   ELAPSED TIME, MIN   5   RECORD ON TRK   1   FILE   2   BASELINE UNSTAGED-50%LOAD
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